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FLOOD INSURANCE STUDY

CITY OF LUFKIN, TEXAS
ANGELINA COUNTY

JUNE 3, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - 480009

ORIGINAL

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance study purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

TABLE OF CONTENTS

1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Authority and Acknowledgments	1
	1.3 Coordination	1
2.0	AREA STUDIED	2
	2.1 Scope of Study	2
	2.2 Community Description	4
	2.3 Principal Flood Problems	6
	2.4 Flood Protection Measures	6
3.0	ENGINEERING METHODS	6
	3.1 Hydrologic Analyses	6
	3.2 Hydraulic Analyses	9
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	10
	4.1 Flood Boundaries	11
	4.2 Floodways	11
5.0	INSURANCE APPLICATIONS	24
	5.1 Reach Determinations	24
	5.2 Flood Hazard Factors	24
	5.3 Flood Insurance Zones	29
	5.4 Flood Insurance Rate Map Description	29

TABLE OF CONTENTS - continued

		Page
6.0	OTHER STUDIES	29
7.0	LOCATION OF DATA	30
8.0	BIBLIOGRAPHY AND REFERENCES	30

FIGURES

Figure 1 - Vicinity Map	3
Figure 2 - Floodway Schematic	12

TABLES

Table 1 - Summary of Discharges	7 - 9
Table 2 - Floodway Data	13 - 23
Table 3 - Flood Insurance Zone Data	25 - 28

EXHIBITS

Exhibit 1 - Flood Profiles	
Hurricane Creek	Panels 01P-04P
Hurricane Creek East Tributary (North)	Panels 05P-07P
Hurricane Creek East Tributary (East)	Panels 08P-09P
Hurricane Creek East Tributary (South)	Panels 10P-11P
Hurricane Creek West Branch	Panels 12P-14P
Cedar Creek	Panels 15P-21P
Cedar Creek North Tributary	Panel 22P
Cedar Creek South Tributary	Panels 23P-25P
Paper Mill Creek Tributary	Panels 26P-28P
Tributary to Paper Mill Creek Tributary	Panels 29P-30P
Mill Creek Tributary	Panels 31P-33P
Tributary to Mill Creek Tributary	Panels 34P-35P
Hurricane Creek East Tributary (East) Tributary	Panel 36P

EXHIBITS - continued

Exhibit 2 - Flood Boundary and Floodway Map Index
Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CITY OF LUFKIN, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Lufkin, Angelina County, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses in this study represent a revision of the original analyses prepared by Bovay Engineers, Inc., for the Federal Emergency Management Agency (FEMA), under Contract No. H-4603. The work for the original analyses was completed in April 1979.

The hydrologic and hydraulic analyses in this revision were prepared by Everett Griffith, Jr. and Associates, Inc., under agreement with FEMA. The work for this revision was completed in December 1986. Hurricane Creek East Tributary (East) and Hurricane Creek East Tributary (East) Tributary were revised in this study.

1.3 Coordination

On August 1977, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA, the City of Lufkin, and Bovay Engineers, Inc., to determine the streams to be studied by detailed methods. A subsequent meeting was held by Bovay Engineers, Inc., and the city to review the study and to collect community input.

A sample press release was sent to the local newspaper. Concurrently, a notification that work was to begin was sent to the city's Mayor along with a copy of the release.

As a part of the data collection and study coordination, contacts were made with the District Office of the Soil Conservation Service (SCS) in Waco, the Fort Worth District of the U. S. Army Corps of Engineers (COE), the U. S. Geological Survey (USGS), the Texas Water Resources Board (TWRB), and the National Weather Service River Forecast Center in Fort Worth.

On September 3, 1980, a final CCO meeting was held with representatives from FEMA, the city, and Bovay Engineers, Inc., to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Lufkin, Angelina County, Texas. The area of study is shown on the Vicinity Map (Figure 1).

The following streams were studied by detailed methods:

Stream	Limits of Detailed Study
Hurricane Creek	for 2.7 miles, from the southern corporate limits to approximately 300 feet north of Lufkin Avenue;
Hurricane Creek East Tributary (North)	for 1.1 miles, from the Southern Pacific Railroad to Hurricane Creek;
Hurricane Creek East Tributary (East)	for 0.3 mile, from the extreme western corporate limits to a point approximately 1,200 feet upstream of U. S. Highway 59;
Hurricane Creek East Tributary (South)	for 0.3 mile, from Brentwood Drive at the southeastern corporate limits to U. S. Highway 59 at the southern corporate limits;
Hurricane Creek West Branch	for 1.4 miles, from Cunningham Lake to the confluence of Hurricane Creek;
Cedar Creek	for 2.6 miles, from Lotus Lane in west-central Lufkin to the southwestern corporate limits;
Cedar Creek North Tributary	for 1.6 miles, from approximately 1,000 feet north of State Highway 94 to its confluence with Cedar Creek;

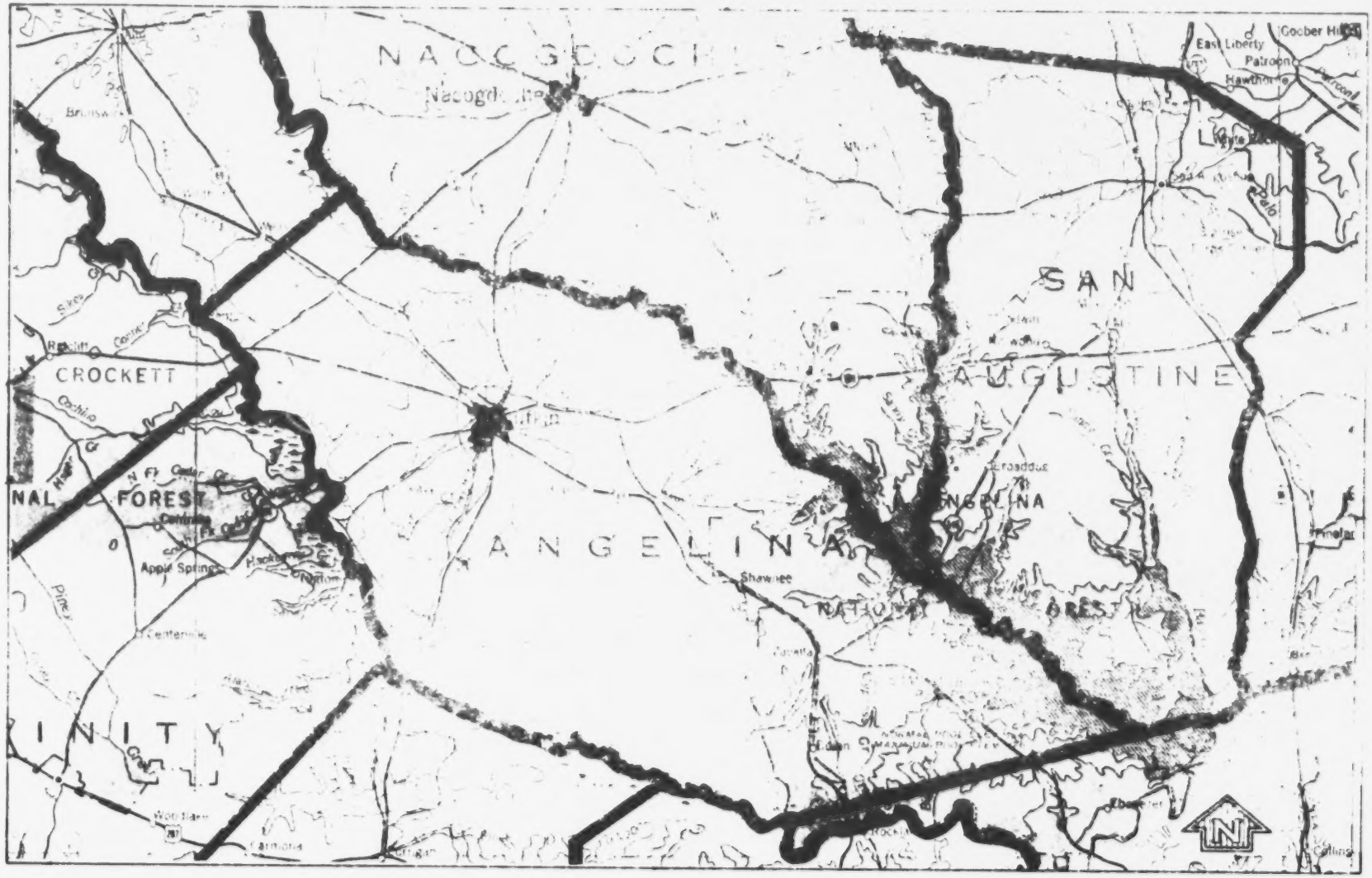


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

APPROXIMATE SCALE

0 8 16 24 MILES

VICINITY MAP

Stream	Limits of Detailed Study
Cedar Creek South Tributary	for 0.6 mile, from approximately 1,150 feet southeast of Lotus Lane to its confluence with Cedar Creek;
Paper Mill Creek Tributary	for 0.8 mile, from approximately 1,050 feet north of Athinson Drive to the northeastern corporate limits by the Angelina and Neches River Railroad track;
Tributary to Paper Mill Creek Tributary	for 1.4 miles, from approximately 2,200 feet west of Herty Street to a junction with Paper Mill Tributary;
Mill Creek Tributary	for 1.0 mile, from Jones Lake to City Lake in northern Lufkin;
Tributary to Mill Creek Tributary	for 1.2 miles, flowing east parallel to the Angelina and Neches River Railroad tracks to City Lake; and
Hurricane Creek East Tributary (East) Tributary	from its confluence with Hurricane Creek East Tributary (East) to a point approximately 1,100 feet upstream.

Hurricane Creek East Tributary (East) was revised from State Route 35 upstream to U. S. Highway 59 and Hurricane Creek East Tributary (East) Tributary was newly studied from its confluence with Hurricane Creek East Tributary (East) to a point approximately 1,100 feet upstream. This revision incorporated updated topographic maps. The remaining streams were taken from the original study. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

Various unnamed streams were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the City of Lufkin.

2.2 Community Description

The City of Lufkin is the county seat of Angelina County and is located in east Texas. It is approximately 120 miles north of Houston, approximately 150 miles southeast of Dallas, and approximately 50 miles west of the Louisiana corporate limits. It is bordered by Burke to the south, Pollock to the west, Nacogdoches to the north, and the City of Huntington to the east.

Lufkin is a leading center for timber industries and supports a population of approximately 25,500. Lufkin also contains such institutions as Angelina College, Lufkin State School (for the mentally retarded), Division Headquarters for the U. S. Forest Service, and the Texas Forest Service Cudlipp Forestry Center. Seventy percent of Angelina County's land is in commercial forests (Reference 1).

Lufkin is accessed by U. S. Highways 59 and 69, plus numerous state and farm to market roads. Several railroads serve the city, particularly in an industrial support capacity. The Angelina and Neches Railroad skirts the northern half of the city just within the corporate limits. In the northwest corner of the community it joins a segment of the St. Louis and Southwestern Railway, which runs northwest-southeast almost all the way through the city. The Texas Southern Railroad joins with this rail spur from the west as the Southern Pacific diagonally bisects the city.

Branches of Cedar Creek run through the west side of Lufkin joining with the main stream just beyond the southwestern portion of the community. The first branch runs approximately 3 miles before crossing the corporate limits in a southwestern direction. From a norhtern direction, a smaller tributary approximately 1.2 miles long, joins the larger branch approximately a third of the way towards the corporate limits. A second tributary also joins the larger branch near the corporate limits after flowing southward along the western corporate limits where the boundary follows a regular path. Irregularities in the western boundary tend to deviate eastward from the stream creating gaps of unincorporated areas within the general stream path.

Hurricane Creek also has several branches that flow in the southern portion of the city before joining the main stream south of the corporate limits. The longest branch (2.5 miles) flows from Cunningham Lake, in the southeastern portion of the city, west and then south to the parent stream beyond the city. The other branches join this larger tributary from the north, one approximately halfway down the first tributary's length to the corporate limits, the other just within the corporate limit.

Lufkin's development occurs mostly in the northwest, southeast, and southwest quadrants of the city. The Central Business District is in the geographical center of town. Residential use occurs mainly in the southwest. Industrial land use occupies much of the west and the northwestern portions of the city, while the timber operations generally occur north of the city. There is also a somewhat scattered commercial usage following the loop route circling the city.

The climate in the Lufkin area is that common to east Texas, with hot, humid summers and mild winters. The average July maximum temperature is 94 degrees Fahrenheit (^{o}F), and the minimum January

temperature is 30°F. Rainfall is plentiful throughout the year with the greater portion of the annual 47 plus inches falling mainly from November through May (Reference 1). This abundant precipitation contributes to the growth of the successful timber industry.

2.3 Principal Flood Problems

The Lufkin area is subject to occasional general flooding from principal streams flowing through the city. Short duration, high intensity storms contribute to these flooding conditions. Definitive information concerning flood losses is not readily available.

2.4 Flood Protection Measures

Flood control measures have been restricted to programs for clearing and maintaining the stream channels within the corporate limits. Structural flood control measures are not presently being planned.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

For the streams studied by detailed methods, except Hurricane Creek East Tributary (East) Tributary, discharge estimates were based on a regional study methodology. Historic discharge records were not

available. The study method was taken from the Technique for Estimating the Magnitude and Frequency of Floods in Texas (Reference 2). The method related drainage area, channel slope, and an index of average annual excess precipitation to the peak discharge by empirical equations. Discharge rates for 10-, 50-, and 100-year frequency floods were determined by use of the empirical equations. Equation constants can be adjusted for each subregional area to compensate for changing conditions within the region. The 500-year discharge was determined by use of the standard log-Pearson Type III method.

Adjustments were made for the extent of urbanization by the application of equations developed by the USGS (Reference 3).

The discharges for Hurricane Creek East Tributary (East) Tributary were determined using the rational method taken from the Texas Highway Department Hydraulic Manual (Reference 4)..

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
HURRICANE CREEK					
At Lufkin Avenue	1.3	1,290	1,820	2,050	2,620
Upstream of confluence with Hurricane Creek East Tributary (North)	2.0	1,480	2,080	2,350	3,000
At U. S. Highway 59	4.0	1,860	2,750	3,150	4,170
Upstream of confluence with Hurricane Creek West Branch	5.1	1,860	2,840	3,270	4,450
Upstream of confluence with Hurricane Creek East Tributary (East)	7.7	2,350	3,580	4,120	5,600
Downstream of confluence with Hurricane Creek East Tributary (East)	9.0	2,460	3,830	4,440	6,080
HURRICANE CREEK EAST TRIBUTARY (NORTH)					
Upstream of confluence with Hurricane Creek	1.5	1,050	1,540	1,760	2,330

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
HURRICANE CREEK EAST TRIBUTARY (EAST)					
Upstream of confluence with Hurricane Creek	1.3	585	1,040	1,240	1,880
HURRICANE CREEK EAST TRIBUTARY (SOUTH)					
At State Highway 35	0.7	340	600	710	1,060
Upstream of confluence with Hurricane Creek	2.1	790	1,410	1,690	2,540
HURRICANE CREEK WEST TRIBUTARY					
At Temple Street	0.7	615	880	1,000	1,300
Upstream of confluence with Hurricane Creek	1.3	800	1,190	1,360	1,800
CEDAR CREEK					
Upstream of confluence with Cedar Creek North Tributary	1.3	1,300	1,830	2,060	2,640
Downstream of confluence with Cedar Creek North Tributary	2.5	1,640	2,440	2,800	3,720
Upstream of confluence with Cedar Creek South Tributary	4.0	1,860	2,770	3,160	4,220
At Gobbler Knob Road	8.2	2,170	3,480	4,070	5,700
CEDAR CREEK NORTH TRIBUTARY					
Upstream of confluence with Cedar Creek	1.3	860	1,310	1,510	2,040
CEDAR CREEK SOUTH TRIBUTARY					
At State Highway 94	1.1	480	820	965	1,420
Upstream of confluence with Cedar Creek	2.2	920	1,480	1,720	2,420
PAPER MILL CREEK TRIBUTARY					
At Oleta Street	0.5	395	630	730	1,020
Upstream of confluence with Tributary to Paper Mill Creek Tributary	1.4	710	1,130	1,320	1,850
At Angelina and Neches River Railroad	3.4	1,320	2,220	2,630	3,800

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
TRIBUTARY TO PAPER MILL CREEK TRIBUTARY					
At Paul Avenue	0.7	505	825	970	1,370
Upstream of confluence with Paper Mill Creek Tributary	1.8	880	1,450	1,700	2,410
MILL CREEK TRIBUTARY					
Upstream of confluence with Tributary to Mill Creek Tributary	1.0	825	1,210	1,380	1,800
At corporate limits	3.4	1,520	2,420	2,830	3,960
TRIBUTARY TO MILL CREEK TRIBUTARY					
At Sellers Street	1.0	970	1,410	1,600	2,110
Upstream of confluence with Mill Creek Tributary	1.9	1,070	1,640	1,890	2,540
HURRICANE CREEK EAST TRIBUTARY (EAST) TRIBUTARY					
At its confluence with Hurricane Creek East Tributary (East)	0.08	226	288	307	465

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analysis for the streams studied by detailed methods were obtained through field survey. All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer

program (Reference 5). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the streams studied by detailed methods were calculated using the slope/area method. The acceptability of all assumed hydraulic factors, cross sections, and hydraulic structure data were checked by computations that duplicated historic flood water profiles.

Channel roughness coefficients (Manning's "n") used in the hydraulic computations for the streams studied by detailed methods were chosen by engineering judgment and based on field observations of the stream and floodplain areas. Channel and overbank "n" values for the streams studied by detailed methods are shown in the following tabulation:

Stream	Channel "n"	Overbank "n"
Hurricane Creek	0.050 - 0.055	0.080 - 0.110
Hurricane Creek East Tributary (North)	0.055	0.080 - 0.110
Hurricane Creek East Tributary (East)	0.060	0.110
Hurricane Creek East Tributary (South)	0.060	0.110
Hurricane Creek West Branch	0.050	0.060 - 0.110
Cedar Creek	0.050	0.110
Cedar Creek North Tributary	0.055	0.110
Cedar Creek South Tributary	0.055	0.110 - 0.100
Paper Mill Creek Tributary	0.055 - 0.060	0.090 - 0.100
Tributary to Paper Mill Creek Tributary	0.060	0.100
Mill Creek Tributary	0.050	0.070 - 0.095
Tributary to Mill Creek Tributary	0.060	0.110
Hurricane Creek East Tributary (East) Tributary	0.060	0.040 - 0.090

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore,

each Flood Insurance Study produces maps designed to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (Reference 6). The boundaries for Hurricane Creek East Tributary (East) Tributary were delineated using topographic maps prepared by Everett Griffith, Jr. and Associates, Inc. (Reference 7).

For the streams studied by approximate methods, the 100-year flood boundaries were delineated using topographic maps and the previous Flood Insurance Study for the City of Lufkin (References 6 and 8).

The 100- and 500-year floodplain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

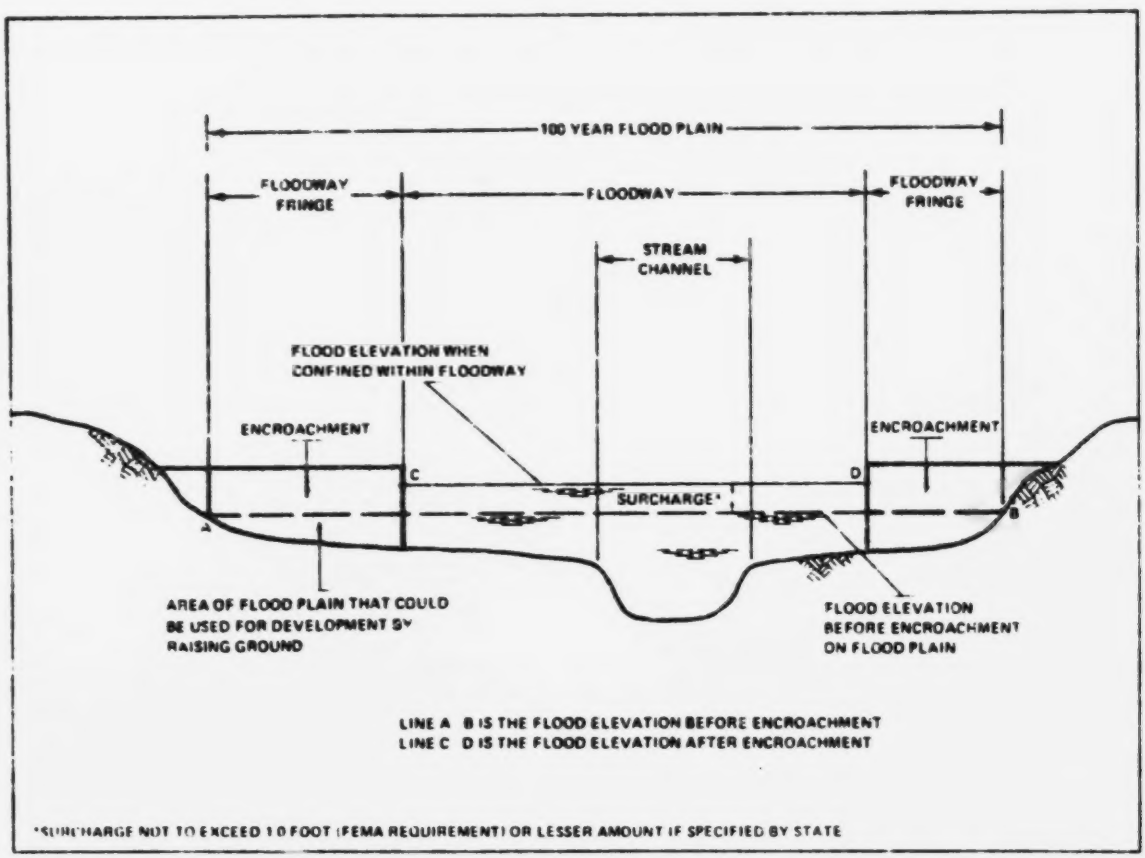
Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the floodplain. The

results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2). Portions of the floodway widths for Hurricane Creek East Tributary (East) and Paper Mill Creek Tributary extend beyond the corporate limits.

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at each cross section. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC Figure 2

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 2

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Hurricane Creek								
A[2]	-400	801	2381	1.9	234.8	234.8	235.8	1.0
B[2]	1,110	829	1391	3.0	237.2	237.2	238.0	0.8
C[2]	2,100	149	1366	3.0	238.4	238.4	239.2	0.8
D[2]	3,450	46	292	14.1	241.0	241.0	241.2	0.2
E	5,000	517	2248	1.8	248.7	248.7	249.2	0.5
F	5,100	40	494	8.3	248.7	248.7	248.9	0.2
G	5,300	40	554	7.4	249.8	249.8	250.4	0.6
H	5,450	441	1650	2.5	251.0	251.0	251.4	0.4
I	7,050	301	2627	1.2	252.2	252.2	252.9	0.7
J	7,600	89	717	4.6	252.4	252.4	253.0	0.6
K	7,900	40	452	7.2	253.1	253.1	253.9	0.8
L	7,970	40	456	6.9	253.2	253.2	254.0	0.8
M	9,320	521	1804	1.7	256.7	256.7	257.4	0.7
N	10,600	249	533	5.9	259.4	259.4	259.7	0.3
O	12,000	332	1355	2.3	264.8	264.8	265.8	1.0
P	12,700	36	405	5.8	266.4	266.4	267.2	0.8
Q	12,720	36	405	5.8	266.4	266.4	267.2	0.8
R	13,920	467	1342	1.8	270.1	270.1	270.7	0.6
S	13,940	480	1445	1.6	270.3	270.3	270.9	0.6
T	14,060	509	1656	1.4	270.4	270.4	271.1	0.7
U	15,710	56	360	6.5	272.9	272.9	273.7	0.8
V	15,790	31	190	12.3	273.2	273.2	273.7	0.5

[1]Feet above confluence of Hurricane Creek East Tributary (E).
[2]Floodway lies outside corporate limits.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOODWAY DATA

HURRICANE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Hurricane Creek (cont.)								
W	15,860	31	232	10.1	274.3	274.3	275.1	0.8
X	16,010	169	774	3.0	276.8	276.8	277.1	0.3
Y	17,540	188	638	3.7	278.9	278.9	279.4	0.5
Z	17,840	30	187	12.6	279.6	279.6	279.9	0.3
AA	17,900	30	242	8.5	281.5	281.5	281.8	0.3
BB	18,400	511	975	2.1	285.2	285.2	285.6	0.4
CC	18,440	512	974	2.1	285.2	285.2	285.6	0.4
DD	18,890	95	547	3.7	286.3	286.3	286.7	0.4
EE	18,910	95	603	3.4	286.9	286.9	287.3	0.4
Hurricane Creek East Tributary (North)								
A	250	203	407	4.3	265.6	265.6	266.6	1.0
B	270	516	1307	1.3	266.0	266.0	267.0	1.0
C	1,200	16	161	10.9	267.3	267.3	268.0	0.7
D	1,220	16	161	10.9	267.3	267.3	268.0	0.7
E	1,420	500	1445	1.2	270.0	270.0	270.4	0.4
F	3,370	200	377	4.7	274.4	274.4	274.4	0.0
G	4,070	293	800	2.2	279.7	279.7	280.4	0.7
H	4,230	22	156	11.3	280.1	280.1	280.8	0.7
I	4,300	319	954	1.8	282.5	282.5	283.3	0.8

[1]Feet above confluence of Hurricane Creek East Tributary (E) for Hurricane Creek; Feet above confluence with Hurricane Creek for Hurricane Creek East Tributary (N).

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOODWAY DATA

HURRICANE CREEK-HURRICANE CREEK EAST TRIBUTARY (NORTH)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Hurricane Creek East Tributary (North) (cont.)								
J	4,950	202	565	4.1	284.9	284.9	284.9	0.0
K	5,050	174	404	4.4	285.1	285.1	285.6	0.5
L	5,115	237	544	3.2	285.1	285.1	285.5	0.4
M	5,915	313	903	1.9	288.7	288.7	289.6	0.9
N	6,045	409	1371	1.3	289.1	289.1	289.9	0.8
O	6,065	416	1408	1.3	289.1	289.1	289.9	0.8
Hurricane Creek East Tributary (East)								
A	-90	75	420	3.0	242.1	242.1	243.1	1.0
B	310	32	198	6.3	243.9	243.9	244.6	0.7
C	360	32	208	6.0	244.3	244.3	245.0	0.7
D	760	359	972	1.3	246.2	246.2	246.6	0.4
E	1,040	18	147	8.4	246.3	246.3	246.9	0.6
F	1,140	18	208	6.0	249.7	249.7	250.3	0.6
G	2,340	142/80[2]	509	2.0	254.1	254.1	254.4	0.3

[1]Feet above confluence with Hurricane Creek for Hurricane Creek East Tributary (N); Feet above the point 340 feet downstream of State Highway 35

[2]Width left channel/width right channel

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOODWAY DATA

HURRICANE CREEK EAST TRIBUTARY (NORTH)
HURRICANE CREEK EAST TRIBUTARY (EAST)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (FPS)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Hurricane Creek East Tributary (South)								
A[2]	-1,580	113	541	3.1	235.6	235.6	236.5	0.9
B[2]	-1,280	20	155	4.6	236.6	236.6	237.5	0.9
C[2]	-1,230	20	156	4.6	236.7	236.7	237.6	0.9
D[2]	-980	470	1278	0.6	237.3	237.3	238.1	0.8
E	220	119	126	5.7	242.7	242.7	242.7	0.0
F	320	74	307	4.3	246.0	246.0	246.5	0.5
G	345	78	196	4.0	246.0	246.0	246.5	0.5
H	495	121	560	1.3	246.6	246.6	247.5	0.9
I	595	186	249	2.9	253.9	253.9	254.0	0.1
J	745	190	335	2.1	254.6	254.6	255.3	0.7
K	945	260	2228	0.3	255.3	255.3	255.9	0.6
L	2,345	73	369	1.9	255.4	255.4	256.0	0.6
Hurricane Creek West Branch								
A	600	205	411	3.3	251.0	249.3[3]	250.3[3]	1.0
B	700	20	169	8.5	251.0	249.5[3]	250.5[3]	1.0
C	710	20	160	8.5	251.0	249.5[3]	250.5[3]	1.0
D	810	232	850	1.6	251.2	251.2	251.8	0.6
E	1,760	70	227	6.0	252.9	252.9	253.6	0.7
F	2,560	100	362	3.8	256.5	256.5	256.7	0.2

[1]Feet above west corporate limits for Hurricane Creek East Tributary (S); feet above confluence with Hurricane Creek for Hurricane Creek West Branch.
[2]Floodway lies outside the corporate limits.
[3]Elevations computed without consideration of backwater effects

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOODWAY DATA

HURRICANE CREEK EAST TRIBUTARY (SOUTH)-
HURRICANE CREEK WEST BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Hurricane Creek West Branch (cont.)								
G	3,640	60	135	10.0	260.6	260.6	260.6	0.0
H	3,810	150	265	5.1	264.4	264.4	264.4	0.0
I	3,850	150	291	4.7	264.7	264.7	264.8	0.1
J	3,950	354	1587	0.9	265.5	265.5	265.7	0.2
K	4,950	27	142	7.1	265.5	265.5	265.9	0.4
L	4,980	27	136	7.3	265.5	265.5	265.9	0.4
M	5,580	62	210	4.8	270.0	270.0	270.0	0.0
Cedar Creek								
A[2]	-730	494	1474	2.8	235.8	235.8	236.8	1.0
B[2]	-76	120	883	4.6	236.6	236.6	237.4	0.8
C[2]	-26	120	887	4.6	236.7	236.7	237.5	0.8
D[2]	0	120	889	4.6	236.7	236.7	237.5	0.8
E	500	96	722	5.6	236.9	236.9	237.6	0.7
F	1,600	90	412	9.9	237.2	237.2	237.9	0.7
G	2,350	50	304	13.4	240.1	240.1	240.1	0.0
H	2,450	94	544	7.5	240.4	240.4	241.4	1.0
I	2,490	90	681	6.0	241.3	241.3	241.5	0.2
J	2,860	73	439	9.3	241.4	241.4	241.8	0.4
K	4,360	66	431	9.4	247.0	247.0	247.0	0.0
L	4,445	68	462	8.8	247.4	247.4	247.4	0.0

[1]Feet above confluence with Hurricane Creek for Hurricane Creek West Branch; feet above southeast corporate limits for Cedar Creek.
[2]Floodway located outside corporate limits.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOODWAY DATA

HURRICANE CREEK WEST BRANCH- CEDAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Cedar Creek (cont.)								
M	4,475	70	499	8.2	247.8	247.8	247.8	0.0
N	5,245	190	529	7.7	250.5	250.5	250.5	0.0
O	5,275	190	652	6.2	250.5	250.5	251.1	0.6
P	5,790	410	2036	2.0	252.7	252.7	253.1	0.4
Q	6,690	433	1121	3.6	253.9	253.9	254.6	0.7
R	6,840	516	1856	1.7	254.7	254.7	255.6	0.9
S	6,940	513	1841	1.7	254.7	254.7	255.6	0.9
T	7,790	528	1954	1.6	255.7	255.7	256.5	0.8
U	8,840	155	654	5.0	257.4	257.4	257.8	0.4
V	9,010	32	240	7.3	258.1	258.1	258.6	0.5
W	9,050	32	381	8.3	259.4	259.4	259.9	0.5
X	9,260	57	437	7.2	260.4	260.4	260.7	0.3
Y	9,760	54	353	8.9	260.7	260.7	261.2	0.5
Z	10,260	50	302	10.5	261.8	261.8	262.0	0.2
AA	10,760	52	301	10.5	263.6	263.6	263.6	0.0
BB	10,960	100	552	5.7	265.6	265.6	265.6	0.0
CC	11,460	90	436	7.2	265.6	265.6	266.5	0.9
DD	11,960	85	476	6.6	267.6	267.6	268.3	0.7
EE	12,280	60	458	6.9	270.6	270.6	271.4	0.8
FF	12,355	60	441	7.2	271.0	271.0	271.7	0.7
GG	12,405	61	513	6.2	272.1	272.1	272.9	0.8

[1]Feet above southeast corporate limits.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOODWAY DATA

CEDAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Cedar Creek (cont.)								
HH	12,890	160	806	3.9	274.3	274.3	274.6	0.3
II	13,080	197	398	7.9	274.3	274.3	275.0	0.7
JJ	13,140	200	403	7.8	276.3	276.3	276.3	0.0
KK	14,010	330	2199	1.3	276.9	276.9	277.4	0.5
LL	15,490	33	190	10.8	276.9	276.9	277.4	0.5
Cedar Creek North Tributary								
A	500	163	747	2.0	277.0[2]	276.6	277.6	1.0
B	840	70	442	3.4	277.1	277.1	277.9	0.8
C	860	72	460	3.3	277.1	277.1	278.1	1.0
D	2,000	25	120	12.6	284.5	284.5	284.6	0.1
Cedar Creek South Tributary								
A	360	40	328	5.2	253.8	252.8[2]	253.8[2]	1.0
B	400	40	328	5.2	253.9	252.8[2]	253.8[2]	1.0
C	775	196	1438	2.8	257.4	257.4	257.6	0.2
D	1,150	291	1486	2.7	257.7	257.7	258.0	0.3
E	1,525	310	1748	2.3	258.1	258.1	258.6	0.5
F	1,625	49	290	14.0	259.7	259.7	259.7	0.0

[1]Feet above southeast corporate limits for Cedar Creek; feet above confluence with Cedar Creek for Cedar Creek North and South tributaries.
[2]Elevation computed without consideration of backwater effects.
[3]Floodway extends outside corporate limits.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF [illegible], TX

(ANGE [illegible])

FLOODWAY DATA

[illegible]DAR CREEK-CEDAR CREEK NORTH TRIBUTARY-CEDAR CREEK SOUTH TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (FPS)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Cedar Creek South Tributary (cont.)								
G	1,665	50	379	10.7	261.7	261.7	261.7	0.0
H	3,435	319	938	1.8	266.9	266.9	267.6	0.7
I	5,075	63	299	5.8	272.6	272.6	273.5	0.9
J	5,095	68	317	5.4	272.9	272.9	273.9	1.0
K_2	5,745	129	547	3.1	276.3	276.3	276.8	0.5
L_2	5,835	56	253	3.8	276.5	276.5	277.2	0.7
M^2	5,895	58	274	3.5	276.5	276.5	277.5	1.0
N	6,425	36	261	3.7	278.0	278.0	278.6	0.6
Paper Mill Creek Tributary								
A_2	-1,430	158	671	3.9	254.4	254.4	255.4	1.0
B_2	-610	85	693	3.8	255.9	255.9	256.8	0.9
C_2	-260	104	529	5.0	256.8	256.8	257.4	0.6
D_2	-240	104	560	4.7	256.9	256.9	257.7	0.8
E_2	-140	86	527	5.0	257.4	257.4	257.9	0.5
F^2	-40	48	453	5.8	257.7	257.7	258.4	0.7
G	0	48[3]	455	5.8	257.8	257.8	258.5	0.7
H	710	330[3]	2705	1.0	258.9	258.9	259.5	0.6
I	1,410	20	162	8.2	258.9	258.9	259.2	0.3

[1]Feet above confluence with Cedar Creek for Cedar Creek South Tributary; feet above
[2]north corporate limits for Paper Mill Creek Tributary.
[3]Floodway located outside corporate limits.
[3]Floodway width extends beyond corporate limits.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOODWAY DATA

CEDAR CREEK SOUTH TRIBUTARY - PAPER MILL CREEK TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Paper Mill Creek Tributary (cont.)								
J	1,670	20	163	8.1	259.1	259.1	259.8	0.7
K	2,360	100	302	4.4	266.1	266.1	266.3	0.2
L	3,760	120	425	3.1	272.5	272.5	272.9	0.4
M	4,280	58	175	4.2	274.7	274.7	274.9	0.2
Tributary to Paper Mill Creek Tributary								
A[2]	900	115	505	3.4	264.0	264.0	265.0	1.0
B[2]	1,700	194	632	2.7	266.4	266.4	267.2	0.8
C	2,750	100	381	4.5	270.9	270.9	271.4	0.5
D	2,870	18	170	10.0	271.9	271.9	272.3	0.4
E	2,930	40	203	8.4	273.2	273.2	273.5	0.3
F	3,430	137	906	1.9	275.2	275.2	275.5	0.3
G	4,580	32	187	5.2	275.9	275.9	276.4	0.5
Mill Creek Tributary								
A[2]	-250	216	791	3.6	255.3	255.3	256.0	0.7
B	800	268	955	3.0	258.3	258.3	258.6	0.3

[1]Feet above north corporate limits for Paper Mill Creek Tributary, and Mill Creek Tributary; Feet above confluence with Paper Mill Creek for Tributary to Paper Mill Creek Tributary.
[2]Floodway located outside corporate limits.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOODWAY DATA

PAPER MILL CREEK TRIBUTARY-

TRIBUTARY TO PAPER MILL CREEK TRIBUTARY-MILL CREEK TRIBUTARY-

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Mill Creek Tributary (cont.)								
C	820	268	955	3.0	258.3	258.3	258.6	0.3
D	3,570	52	401	3.4	273.8	273.8	274.8	1.0
E	3,710	52	394	3.5	274.0	274.0	275.0	1.0
F	3,770	70	746	1.9	274.3	274.3	275.2	0.9
G	3,790	70	746	1.9	274.3	274.3	275.2	0.9
H	4,240	234	1428	1.0	274.4	274.4	275.3	0.9
I	4,900	142	658	2.1	274.6	274.6	275.5	0.9
J	5,820	203	656	2.1	279.8	279.8	279.8	0.0
K	5,850	203	784	1.8	281.1	281.1	281.1	0.0
L	7,180	89	197	7.0	285.7	285.7	285.8	0.1
Tributary to Mill Creek Tributary								
A	140	52	362	5.2	274.0	274.0	275.0	1.0
B	680	123	301	6.3	279.4	279.4	279.5	0.1
C	800	195	799	2.4	281.2	281.2	282.1	0.9
D	830	201	907	2.1	281.6	281.6	282.5	0.9
E	1,710	195	871	2.2	284.1	284.1	284.7	0.6
F	3,130	150	300	5.3	291.7	291.7	292.4	0.7

[1]Feet above north corporate limits for Mill Creek; Feet above the point of discharge to City Lake for Tributary to Mill Creek Tributary.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOODWAY DATA

MILL CREEK TRIBUTARY - TRIBUTARY TO MILL CREEK TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Hurricane Creek East Tributary (East) Tributary								
A	425	53	136	2.3	245.5	245.5	246.0	0.5
B	543	78	146	2.1	245.9	245.9	246.4	0.5
C	743	23	60	5.1	247.4	247.4	247.4	0.0

[1]Feet above confluence with Hurricane Creek East Tributary (East)

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TEXAS
(ANGELINA CO)

FLOODWAY DATA

HURRICANE CREEK EAST TRIBUTARY (EAST) TRIBUTARY

for certain downstream cross sections of Hurricane Creek West Branch, Cedar Creek North Tributary, and Cedar Creek South Tributary are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

5.0 INSURANCE APPLICATIONS

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail in the City of Lufkin.

5.1 Reach Determinations

Reaches are defined as sections of floodplain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following tabulation for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the City of Lufkin are shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1 0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3]
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Hurricane Creek							
Reach 1	0010	-1.87	-0.48	+0.95	020	A4	Varies
Reach 2	0010	-1.07	-0.32	+0.53	010	A2	Varies
Hurricane Creek East Tributary (North)							
Reach 1	0010	-0.94	-0.06	+0.63	010	A2	Varies
Hurricane Creek East Tributary (East)							
Reach 1	0010	-2.12	-0.15	+0.69	020	A4	Varies
Hurricane Creek East Tributary (South)							
Reach 1	0010	-0.98	-0.21	+0.63	010	A2	Varies

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT SEE MAP

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOOD INSURANCE ZONE DATA

HURRICANE CREEK-HURRICANE CREEK EAST TRIBUTARY (NORTH)- HURRICANE CREEK EAST TRIBUTARY (EAST)-HURRICANE CREEK EAST TRIBUTARY (SOUTH)

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3]
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Hurricane Creek West Branch							
Reach 1	0010	-1.21	-0.26	+0.72	010	A2	Varies
Reach 2	0010	-1.88	-0.42	+0.43	020	A4	Varies
Reach 3	0010	-0.75	-0.58	+0.34	010	A2	Varies
Cedar Creek							
Reach 1	0010	-1.28	-0.36	+1.07	015	A3	Varies
Reach 2	0005,0010	-2.00	-0.46	+0.82	020	A4	Varies
Cedar Creek North Tributary							
Reach 1	0005	-1.54	-0.35	+0.64	015	A3	Varies
Cedar Creek South Tributary							
Reach 1	0010	-1.53	-0.39	+1.00	015	A3	Varies

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT SEE MAP

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOOD INSURANCE ZONE DATA

HURRICANE CREEK WEST BRANCH-CEDAR CREEK-
CEDAR CREEK NORTH TRIBUTARY- CEDAR CREEK SOUTH TRIBUTARY

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3]
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Paper Mill Creek Tributary							
Reach 1	0005	-2.01	-0.36	+ .98	020	A4	Varies
Reach 2	0005	-1.27	-0.34	+ .81	015	A3	Varies
Tributary to Paper Mill Creek Tributary							
Reach 1	0005	-1.65	-0.35	+ .64	015	A3	Varies
Reach 2	0005	-2.51	-0.60	+1.31	025	A5	Varies
Mill Creek Tributary							
Reach 1	0005	-1.22	-0.22	+0.72	010	A2	Varies
Reach 2	0005	-1.43	-0.24	+0.21	015	A3	Varies
Reach 3	0005	-0.44	-0.60	+0.45	005	A1	Varies
Tributary to Mill Creek Tributary							
Reach 1	0005	-0.79	-0.19	+0.55	010	A2	Varies

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT-SEE MAP

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOOD INSURANCE ZONE DATA

PAPER MILL CREEK TRIBUTARY- TRIBUTARY TO PAPER MILL CREEK TRIBUTARY-
MILL CREEK TRIBUTARY- TRIBUTARY TO MILL CREEK TRIBUTARY

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100 YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Hurricane Creek East Tributary (East) Tributary Reach 1	10	-0.3	-0.1	+0.3	005	A1	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF LUFKIN, TEXAS
(ANGELINA CO)

FLOOD INSURANCE ZONE DATA

HURRICANE CREEK EAST TRIBUTARY (EAST) TRIBUTARY

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and various from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A1, A2, A3, A4, and A5:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levees, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Lufkin is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

A report prepared by Everett Griffith, Jr. Associates entitled Ellen Trout and Jones Lake Impoundments was the only published information on

streams in the study area. Findings of the report were reviewed for consistency with this report but a direct correlation was not sought. The report was based on discharges calculated by use of the rational formula, Q=CIA, which has been judged unacceptable for these analyses.

Due to its more detailed nature, this study supersedes the previous Flood Insurance Study for the City of Lufkin (Reference 8).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Federal Regional Center, 800 North Loop 288, Denton, Texas 76201-3698.

8.0 BIBLIOGRAPHY AND REFERENCES

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2. U. S. Department of the Interior, Geological Survey, Open-File Report 77-110, Technique for Estimating the Magnitude and Frequency of Floods in Texas, Washington, D. C., 1977.

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Chow, Ven Te, ed., Handbook of Applied Hydrology, New York, McGraw-Hill, 1964.

Chow, Ven Te, Open-Channel Hydraulics, New York, McGraw-Hill, 1959.

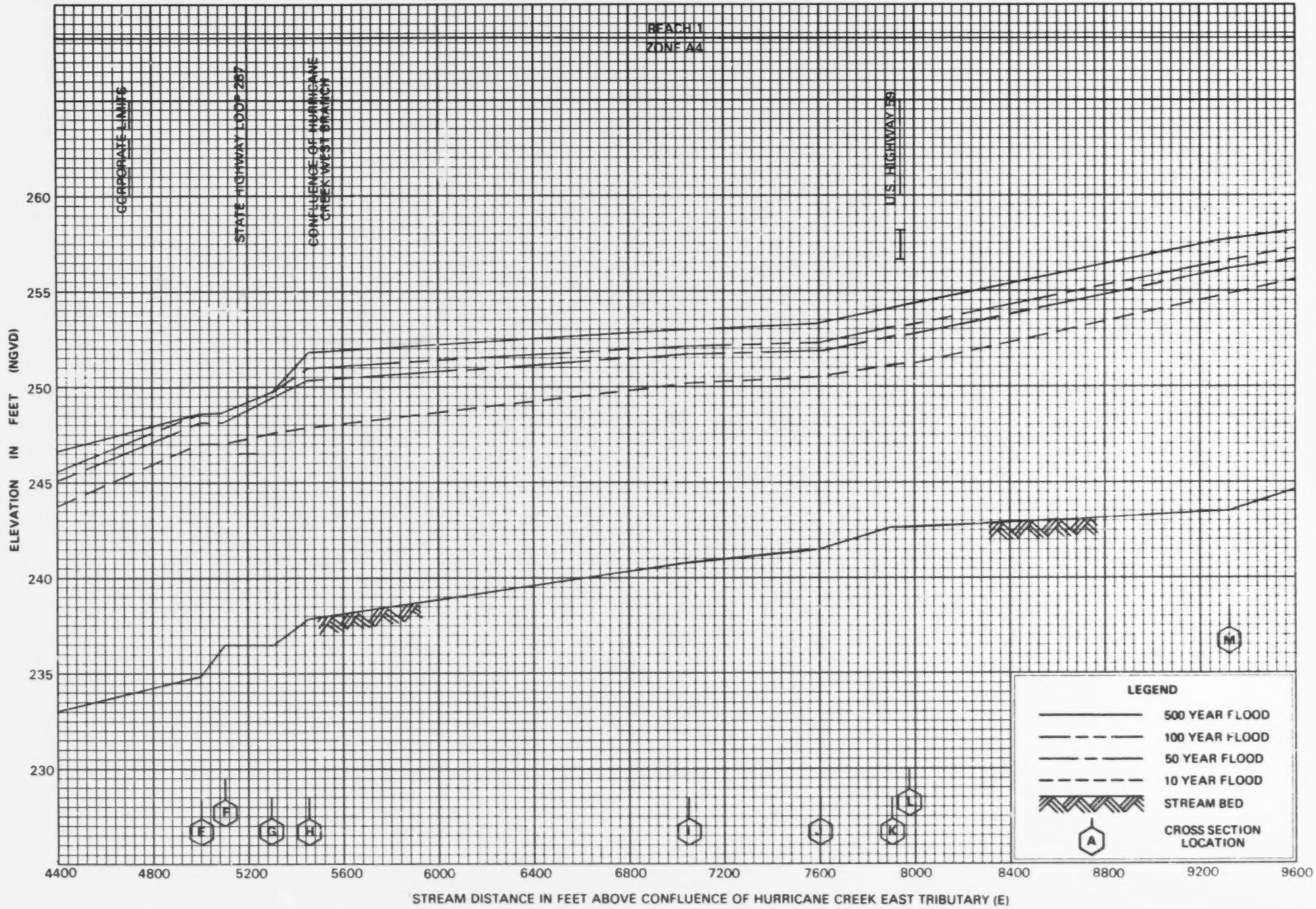
FLOOD PROFILES

HURRICANE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

01P



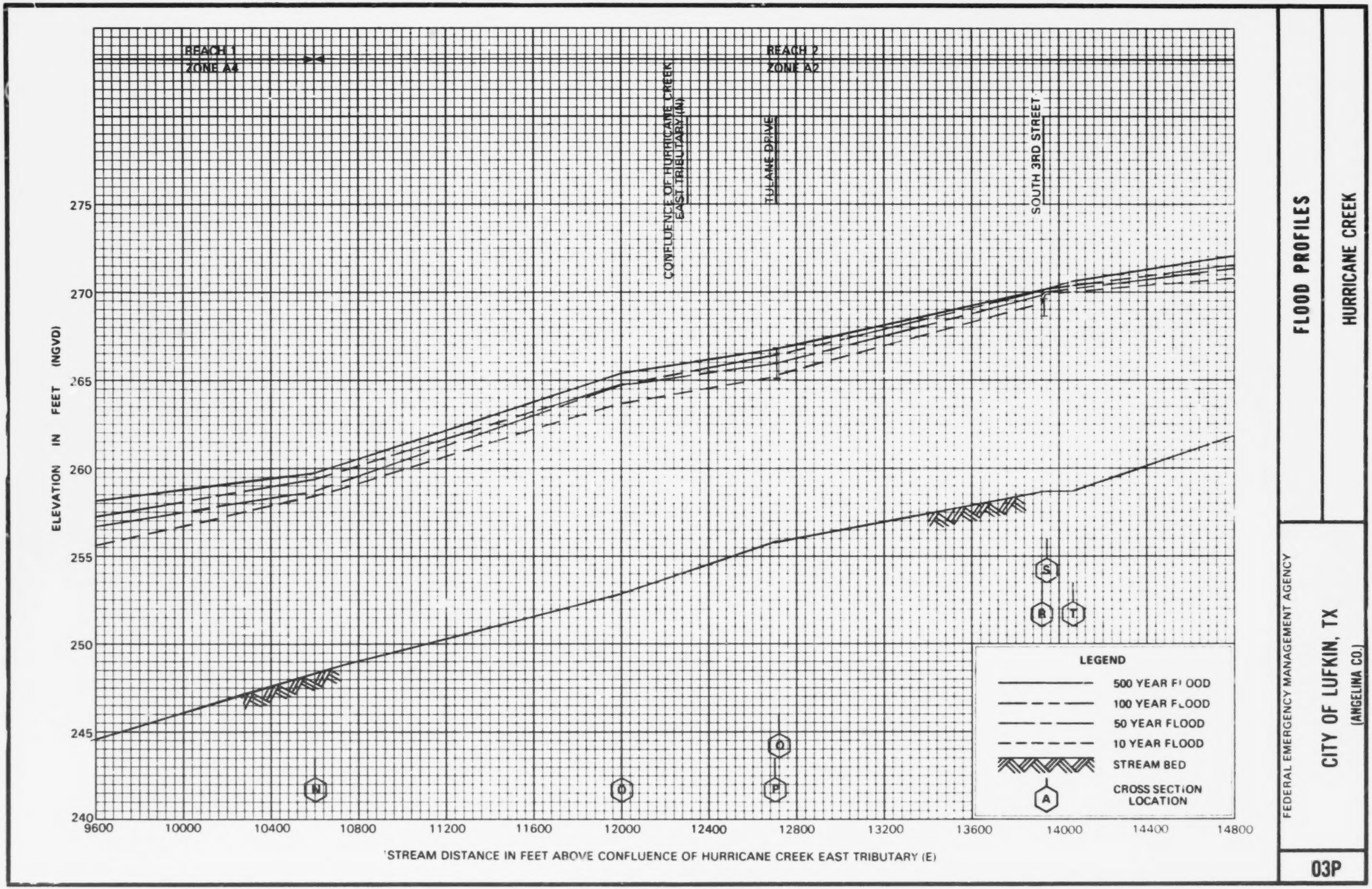
FLOOD PROFILES

HURRICANE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

02P



FLOOD PROFILES

HURRICANE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

03P

REACH 2
ZONE A2

DENMAN AVENUE
CHESTNUT STREET
U.S. HIGHWAY 59
(TIMBERLAND DRIVE)
LUFKIN AVENUE
OOZIER AVENUE
ST. LOUIS AND SOUTHWESTERN RAILWAY
LIMIT OF DETAILED STUDY

ELEVATION IN FEET (NGVD)

290
285
280
275
270
265
260

14800 15200 15600 16000 16400 16800 17200 17600 18000 18400 18800 19200

DOWNSTREAM DISTANCE IN FEET ABOVE CONFLUENCE OF HURRICANE CREEK EAST TRIBUTARY (E)

U V W X Y Z AA BB CC DD EE

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- A — CROSS SECTION LOCATION

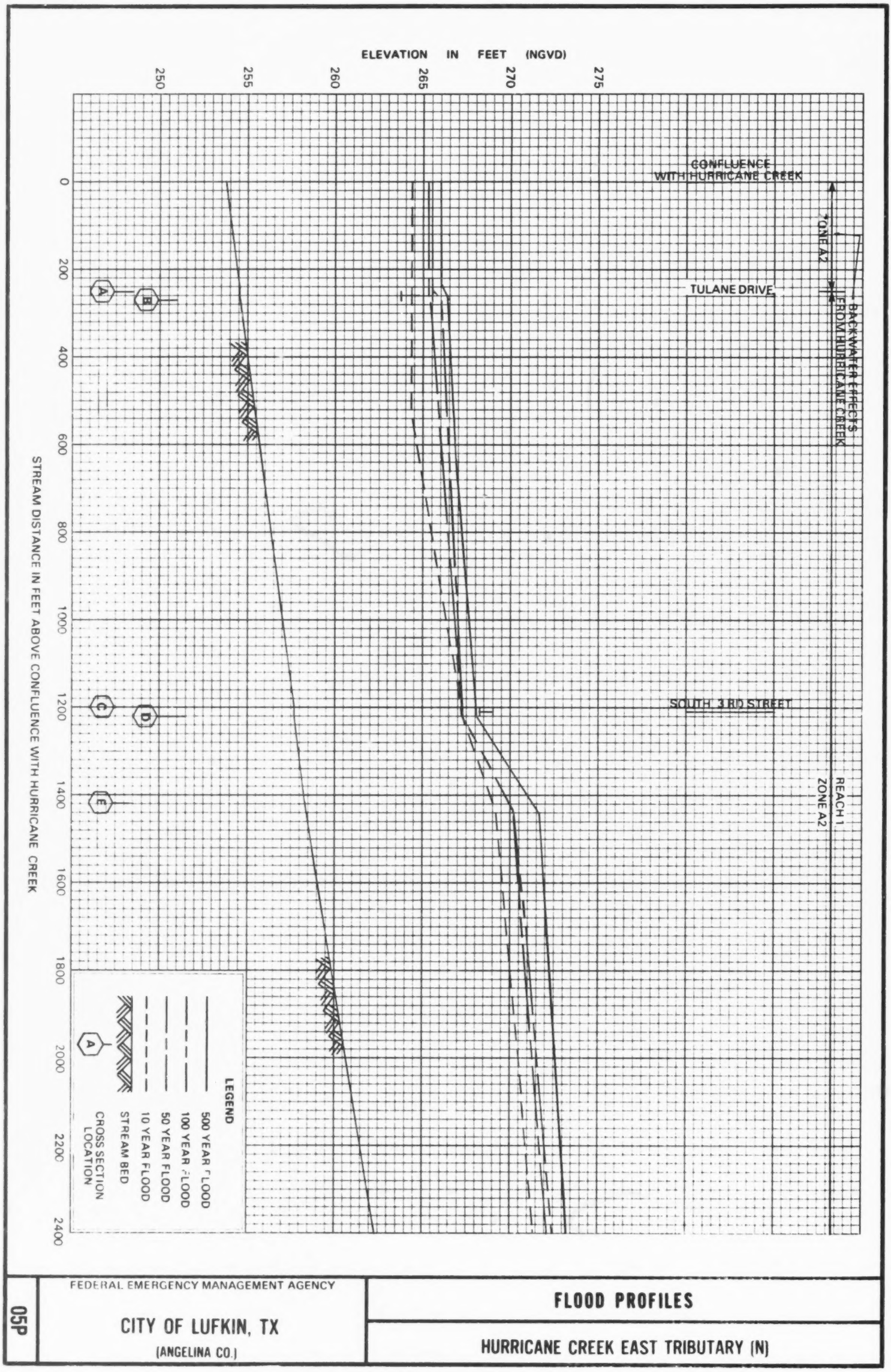
FLOOD PROFILES

HURRICANE CREEK

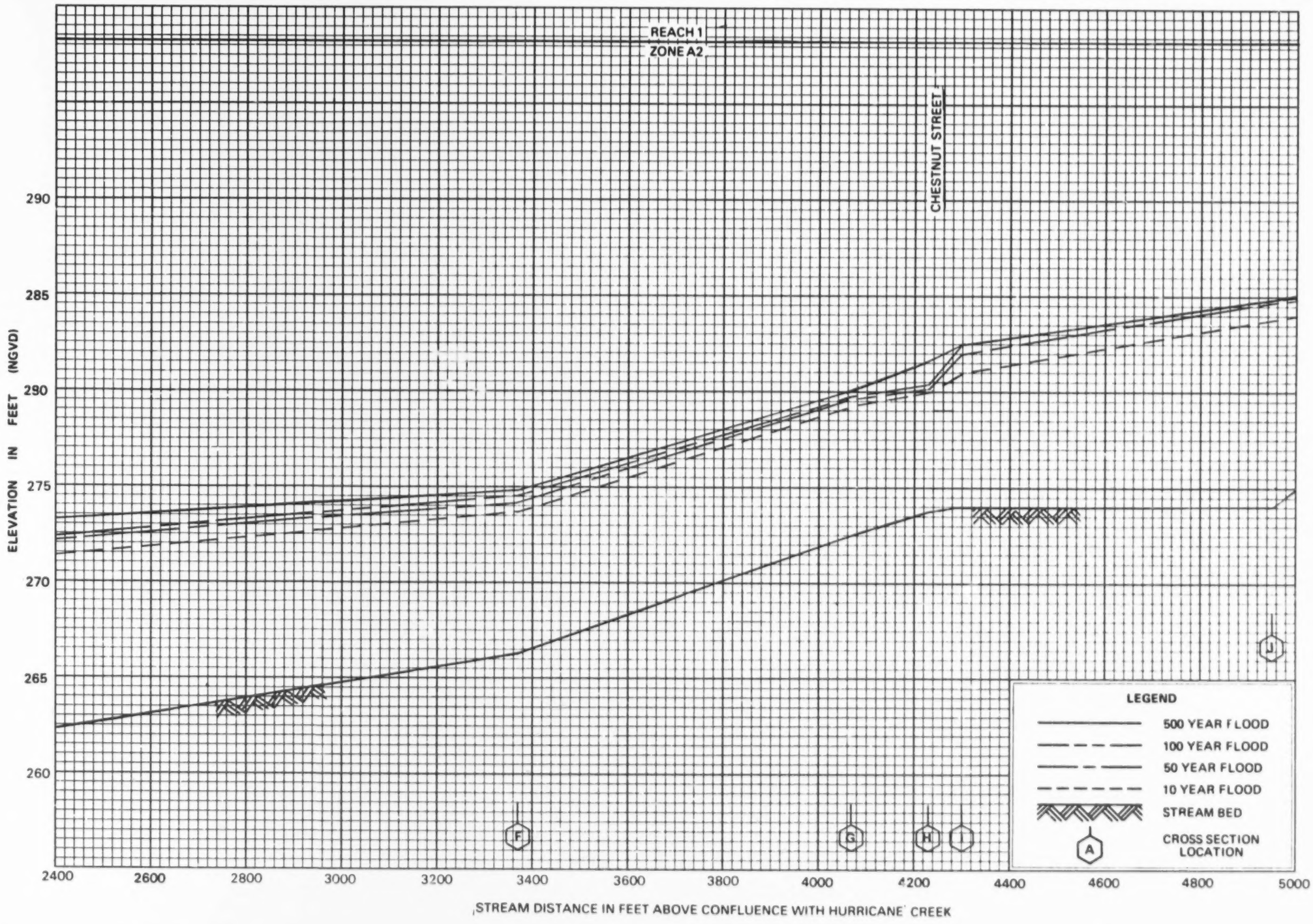
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

04P



05P	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOOD PROFILES
	CITY OF LUFKIN, TX (ANGELINA CO.)	HURRICANE CREEK EAST TRIBUTARY (N)



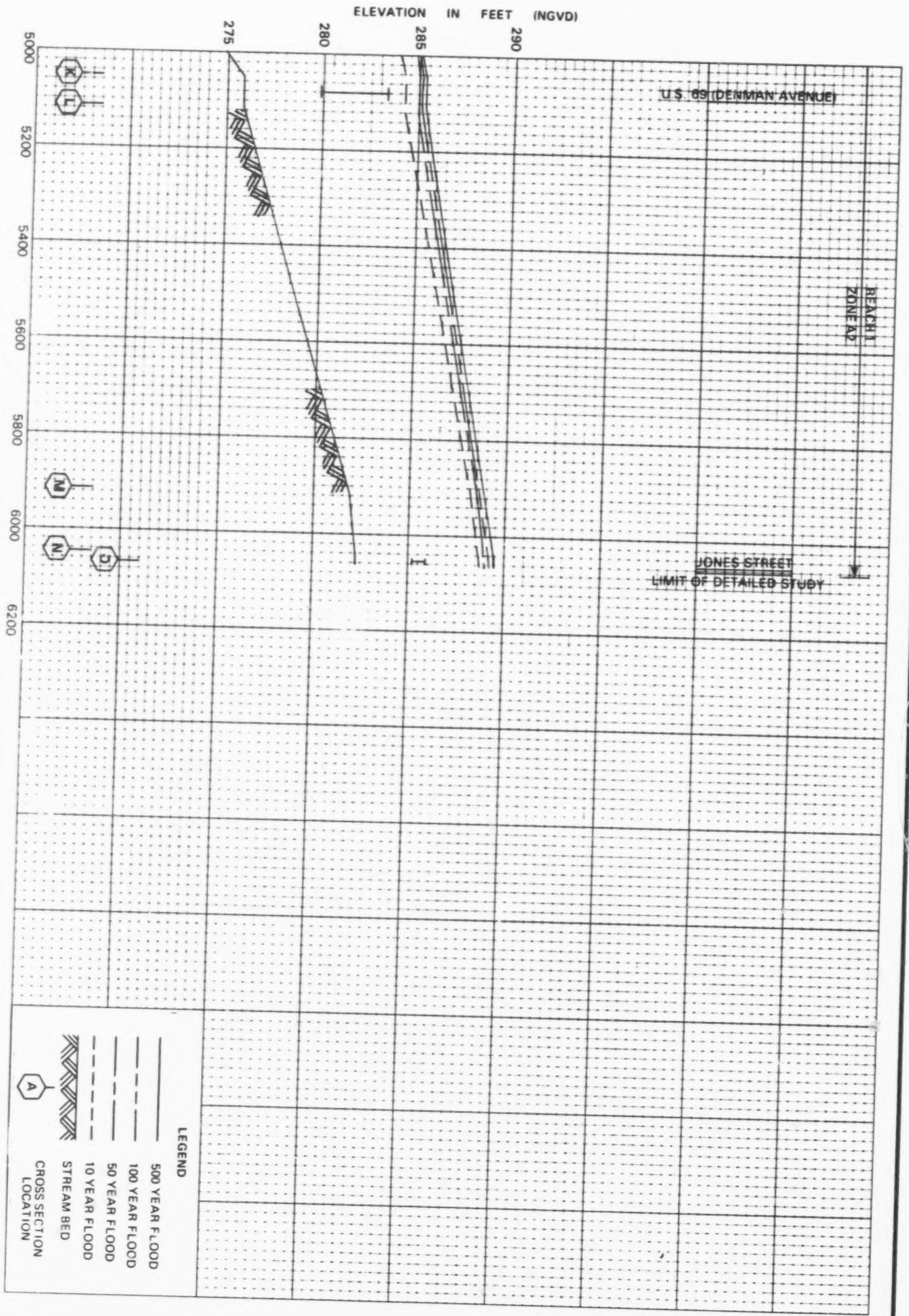
FLOOD PROFILES

HURRICANE CREEK EAST TRIBUTARY (N)

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

06P



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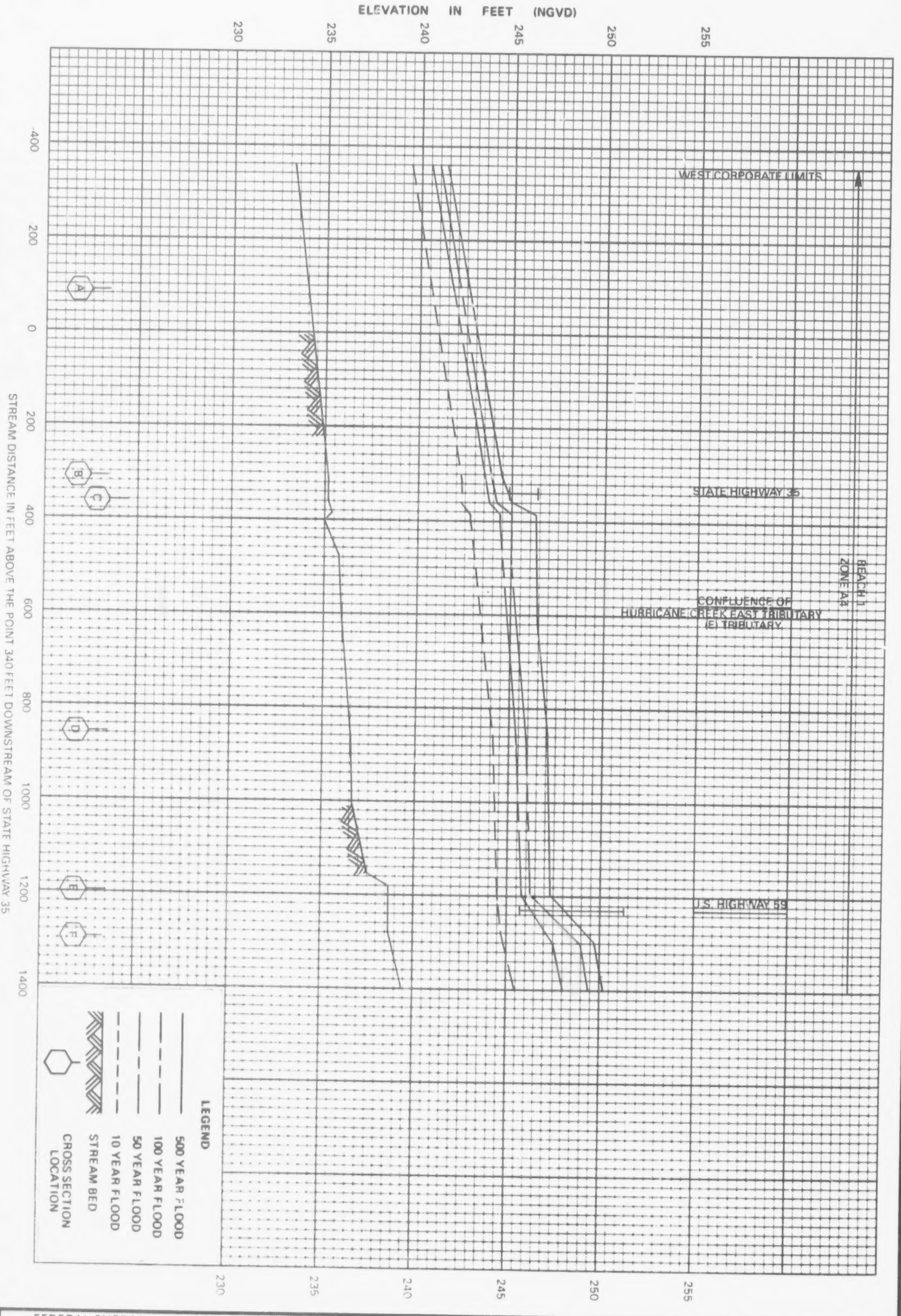
07P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF LUFKIN, TX (ANGELINA CO.)	FLOOD PROFILES HURRICANE CREEK EAST TRIBUTARY (N)



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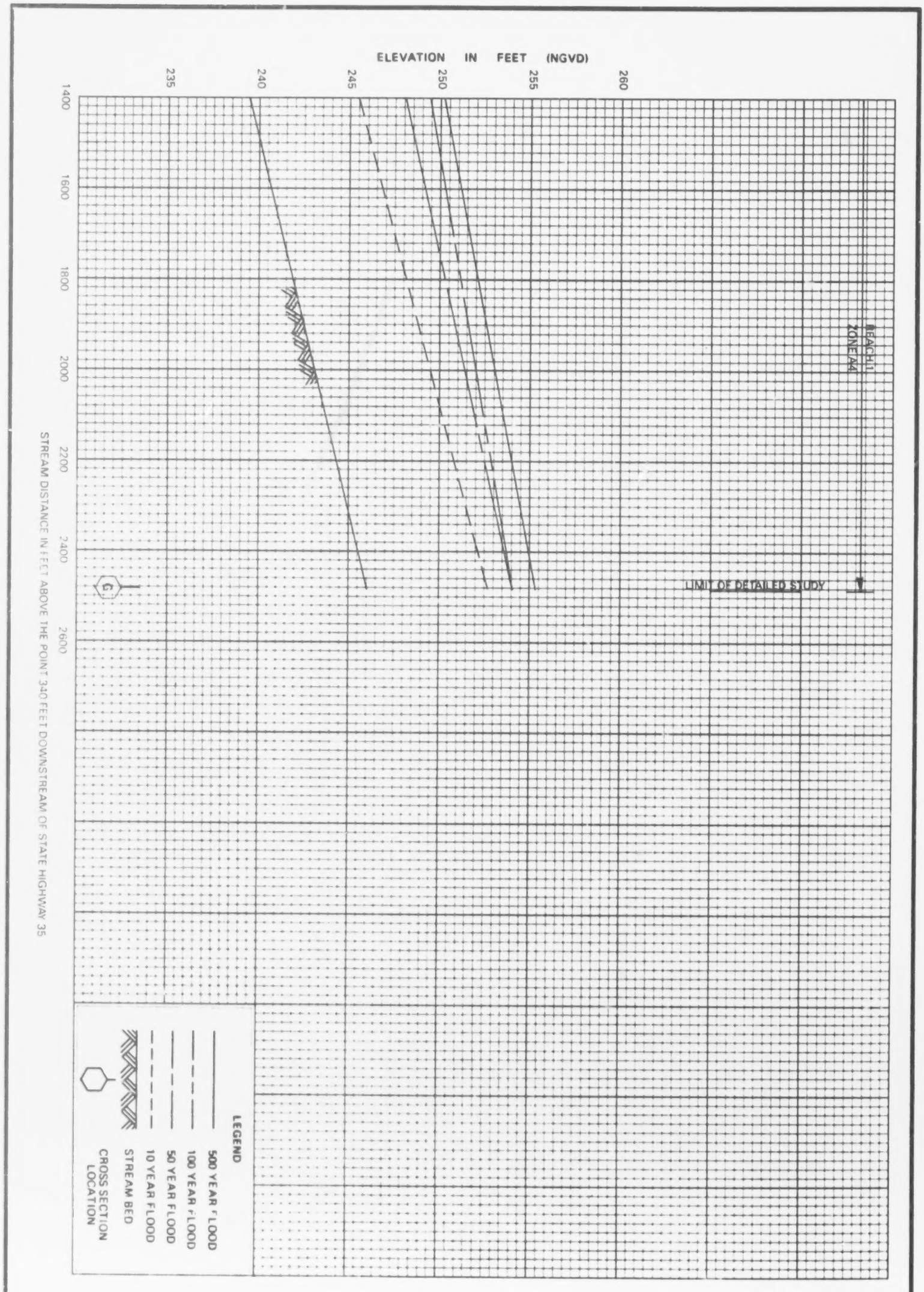

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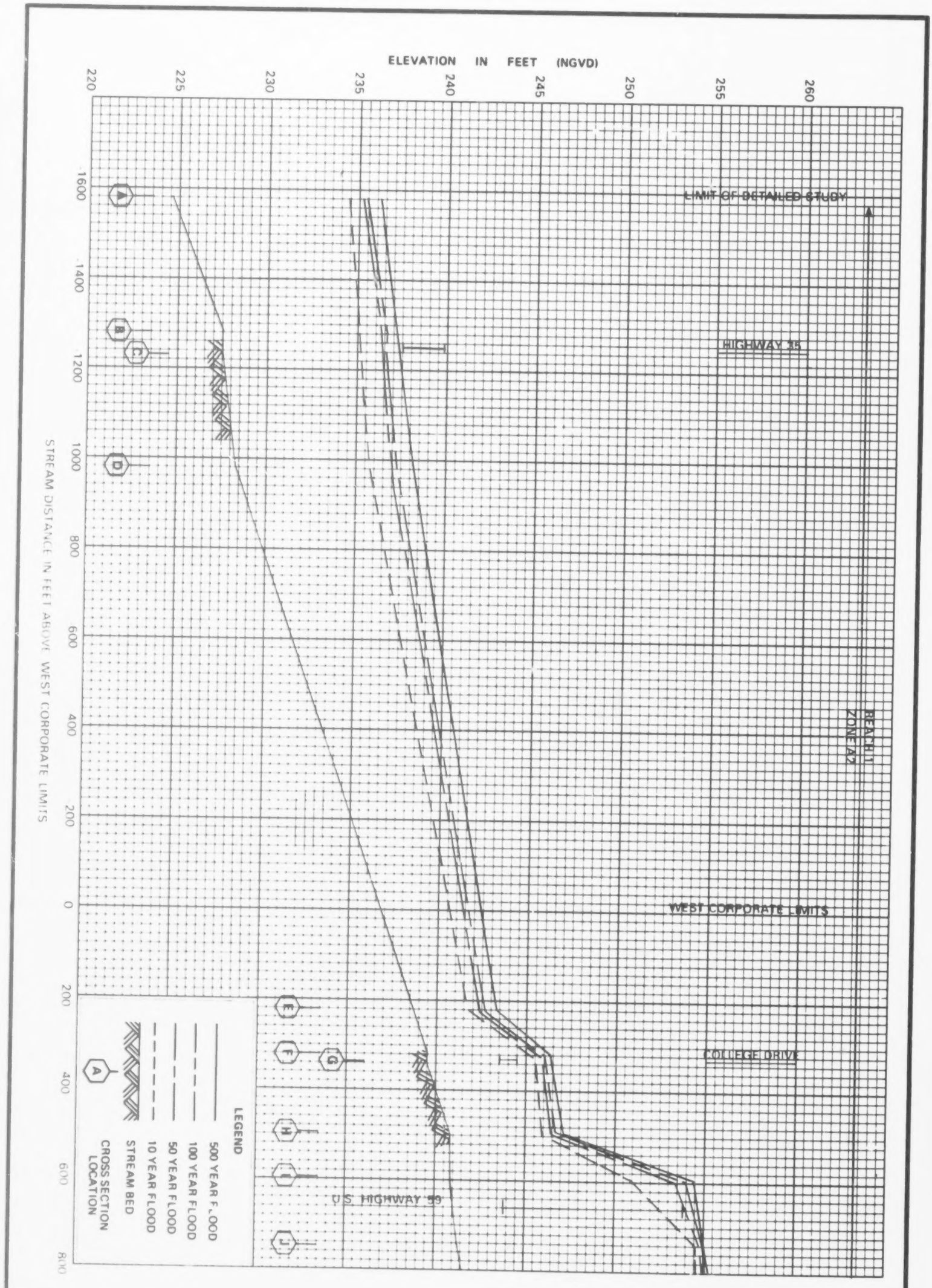


10P

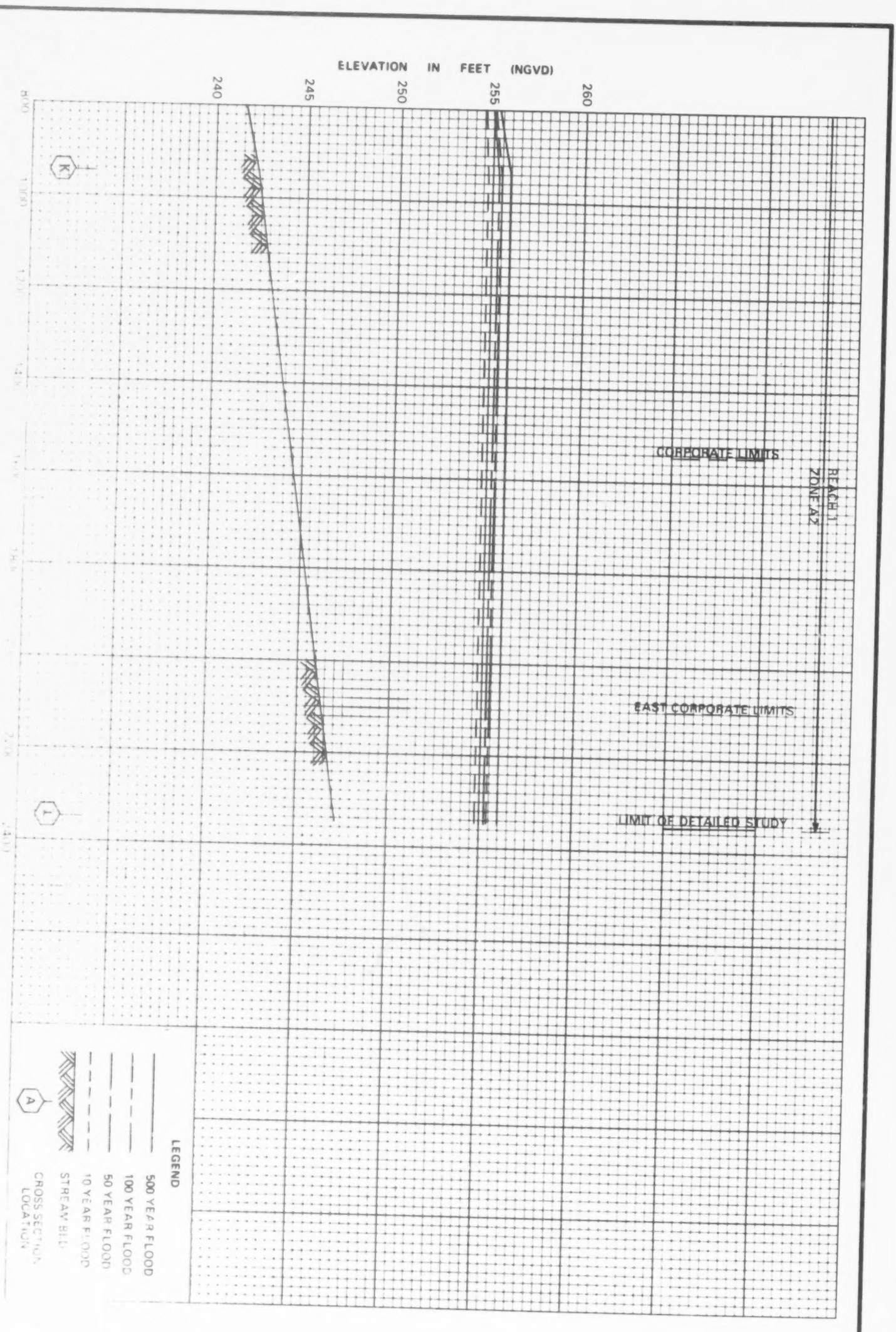
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOOD PROFILES

HURRICANCE CREEK EAST TRIBUTARY (S)



FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOOD PROFILES

HURRICANCE CREEK EAST TRIBUTARY (S)

11P

BACKWATER EFFECTS FROM HURRICANE CREEK
ZONE A4

REACH 1
ZONE A2

WITH CONFLUENCE
WITH HURRICANE CREEK

DIRT ROAD

ELEVATION IN FEET (NGVD)

260
255
250
245
240
235

0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH HURRICANE CREEK

A B C D E

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- A — CROSS SECTION LOCATION

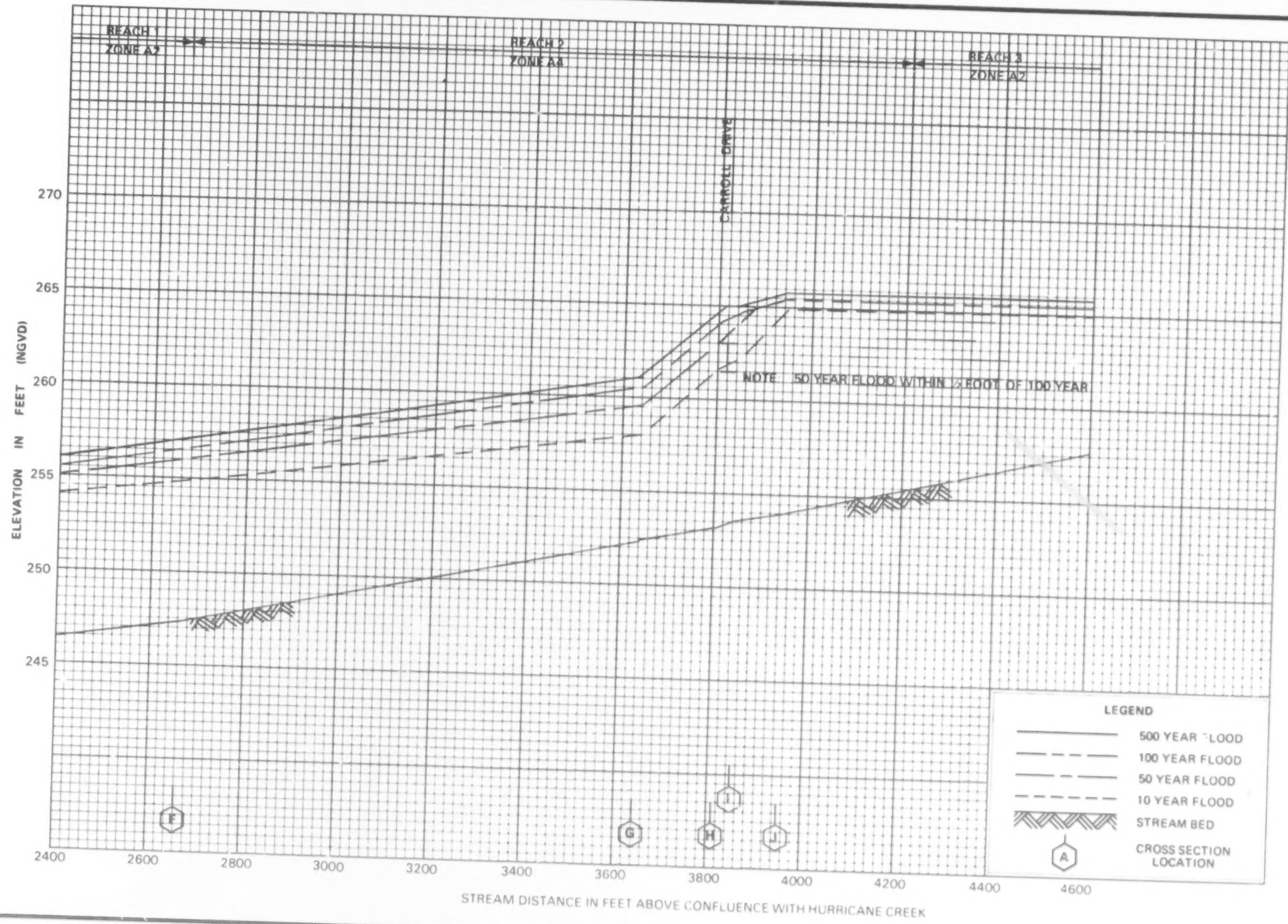
FLOOD PROFILES

HURRICANE CREEK WEST BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

12P



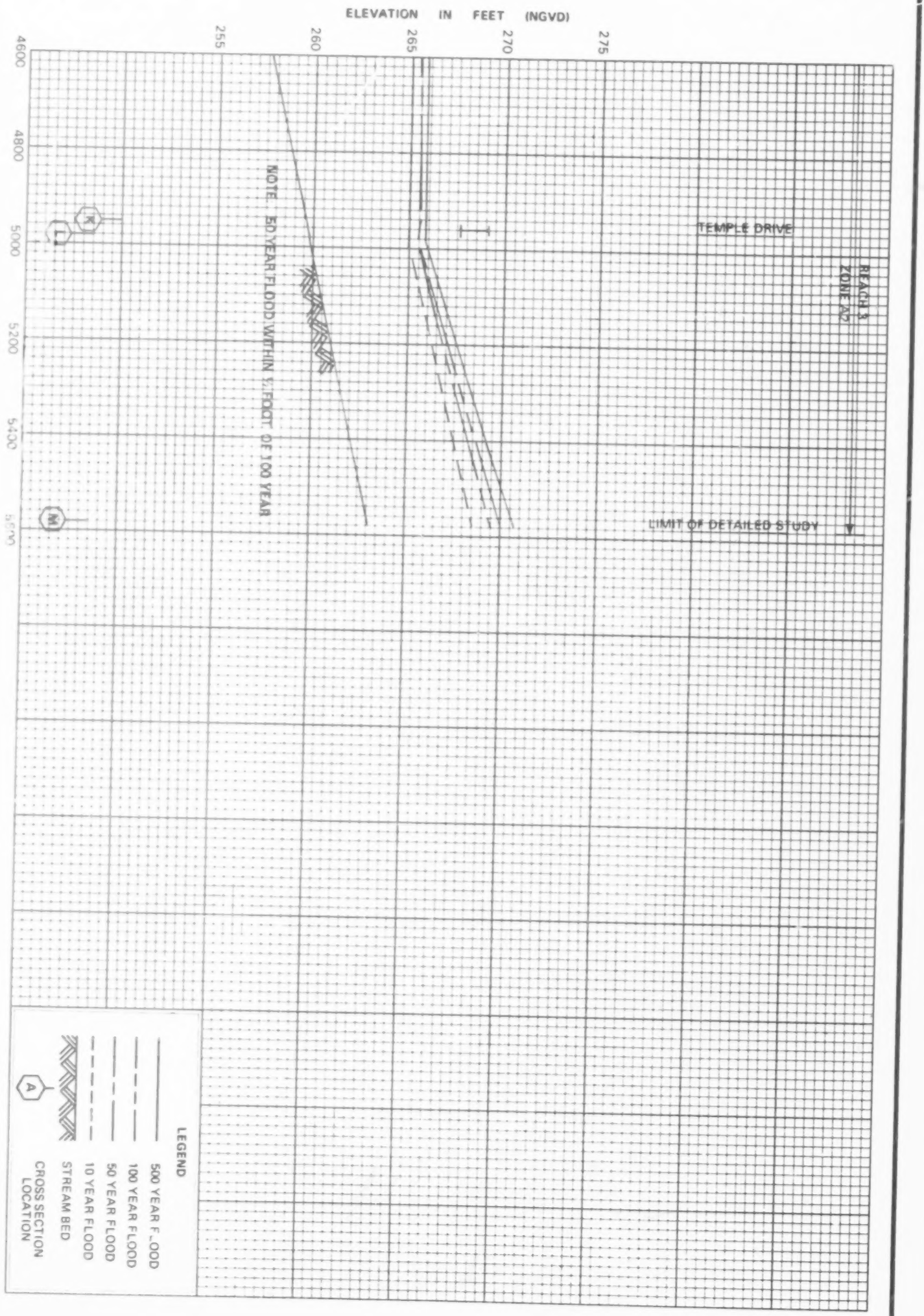
FLOOD PROFILES

HURRICANE CREEK WEST BRANCH

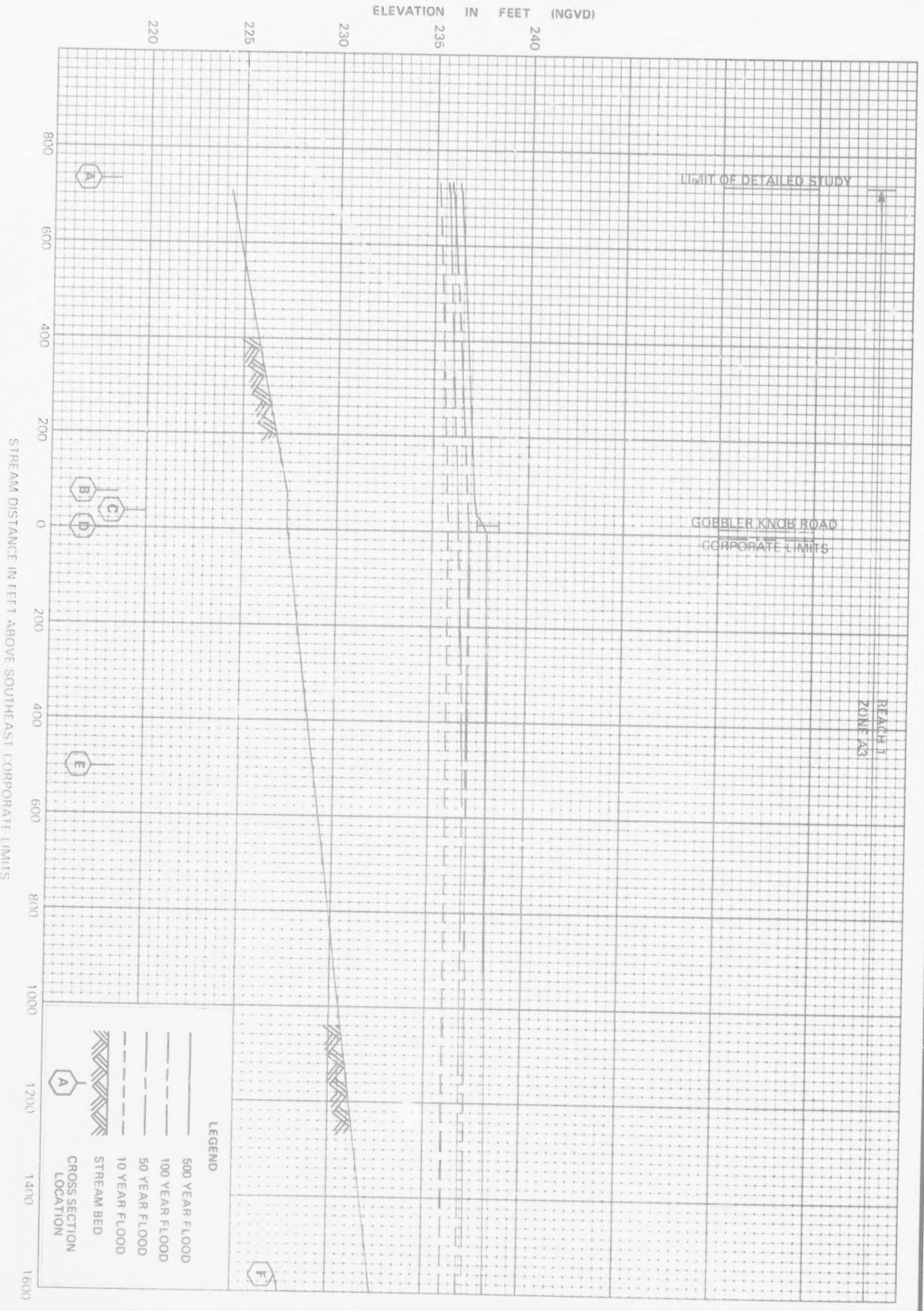
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

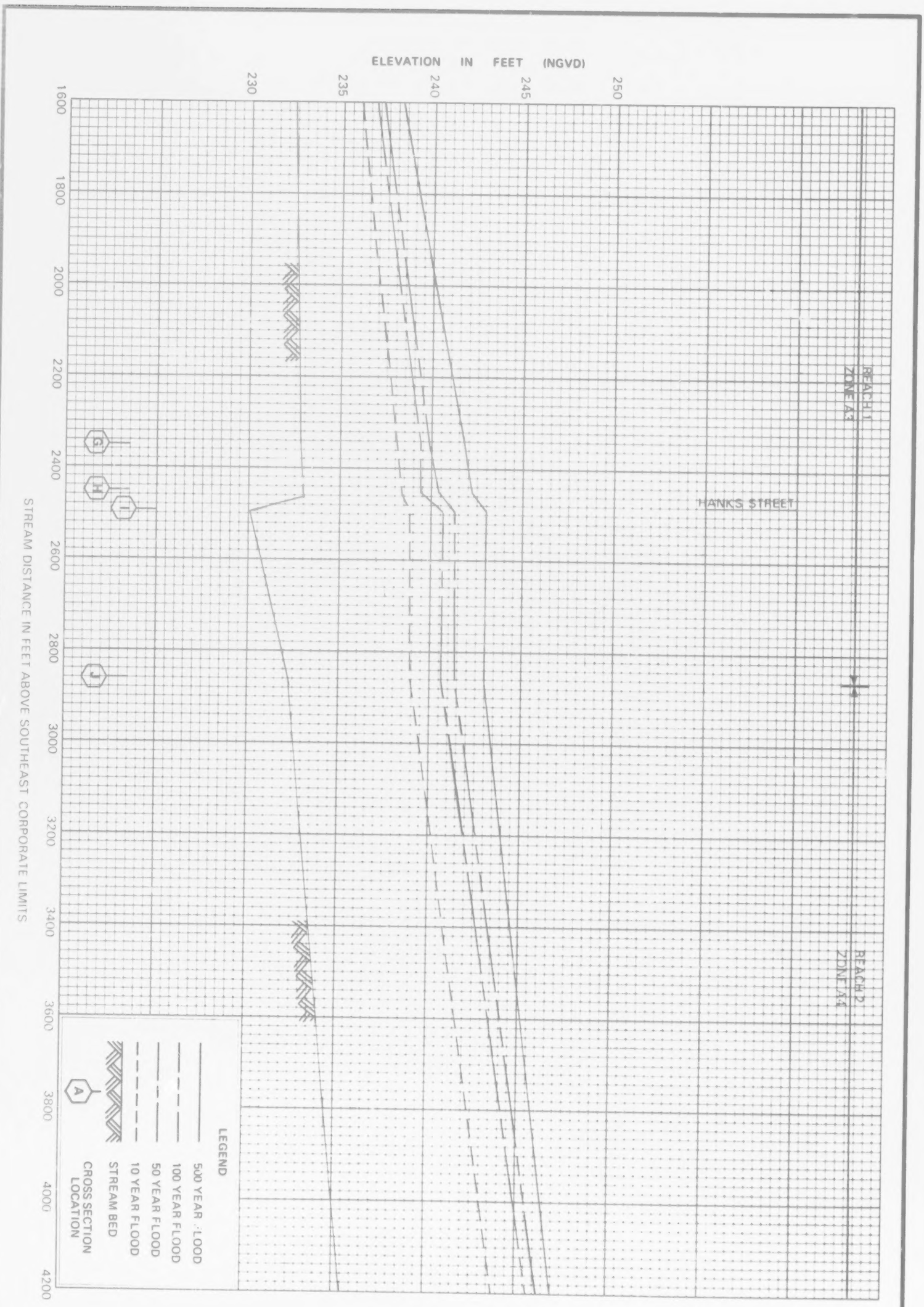
13P



14P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF LUFKIN, TX (ANGELINA CO.)	FLOOD PROFILES HURRICANE CREEK WEST BRANCH



15P	FEDERAL EMERGENCY MANAGEMENT AGENCY	FLOOD PROFILES
	CITY OF LUFKIN, TX (ANGELINA CO.)	CEDAR CREEK



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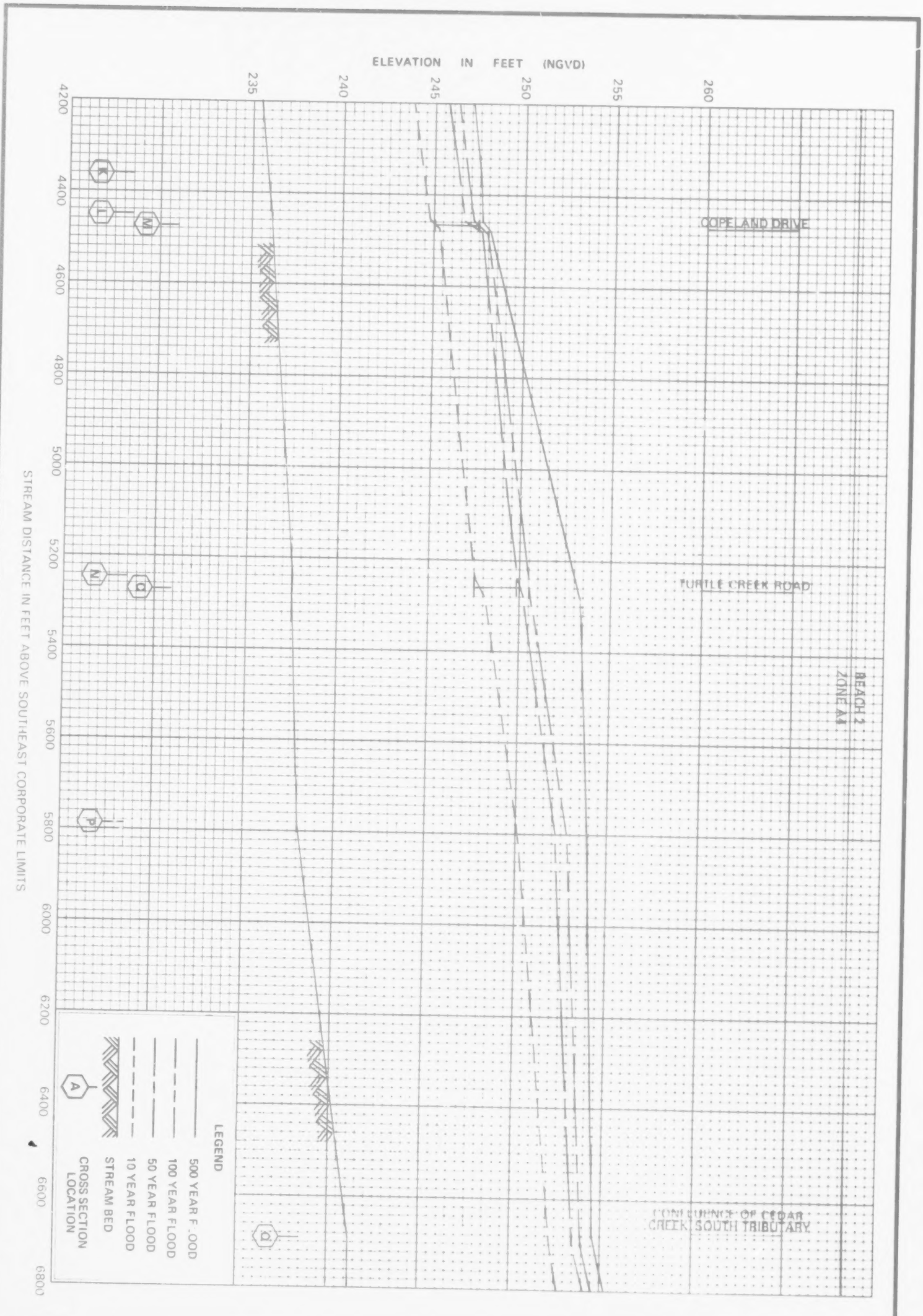
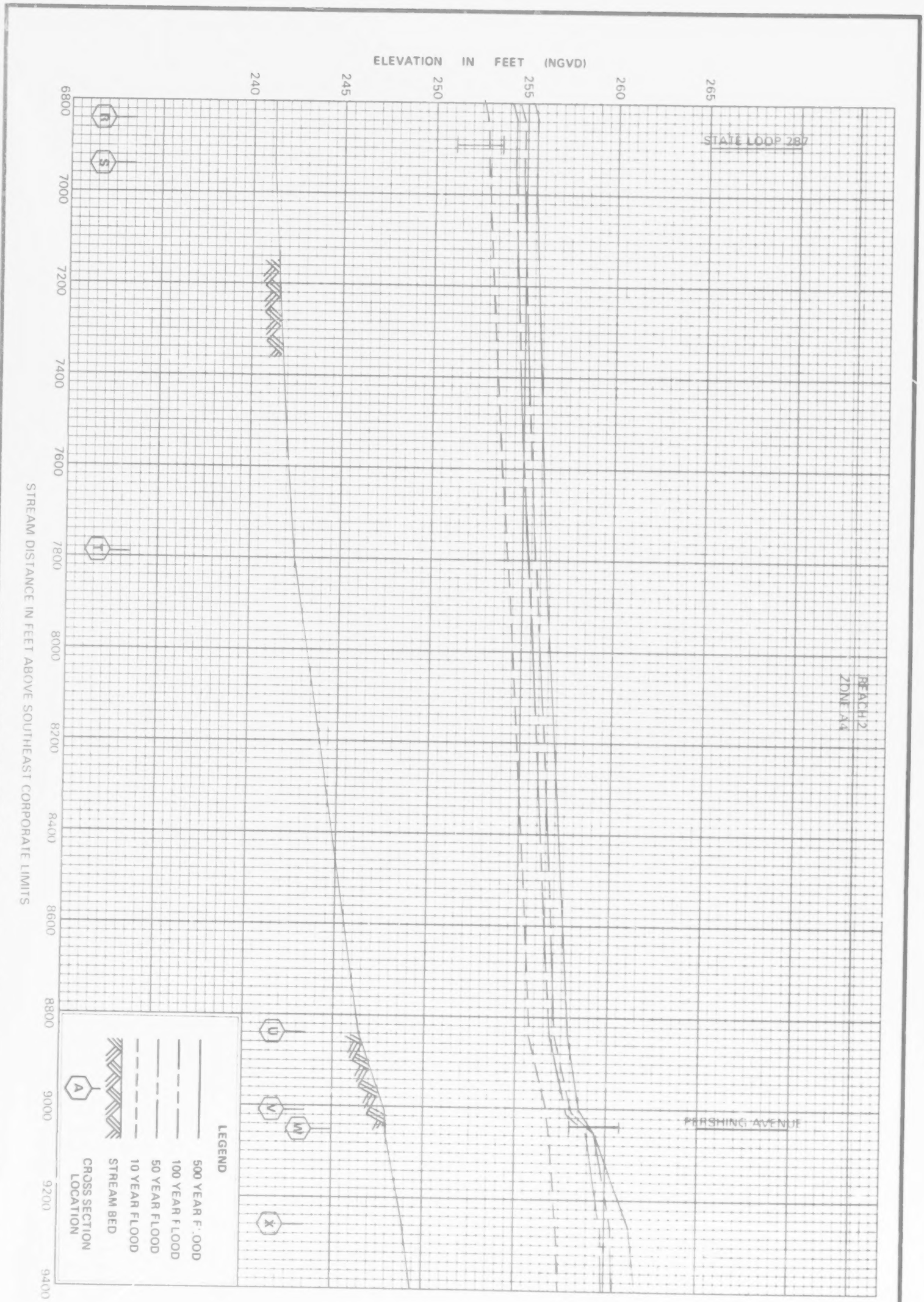
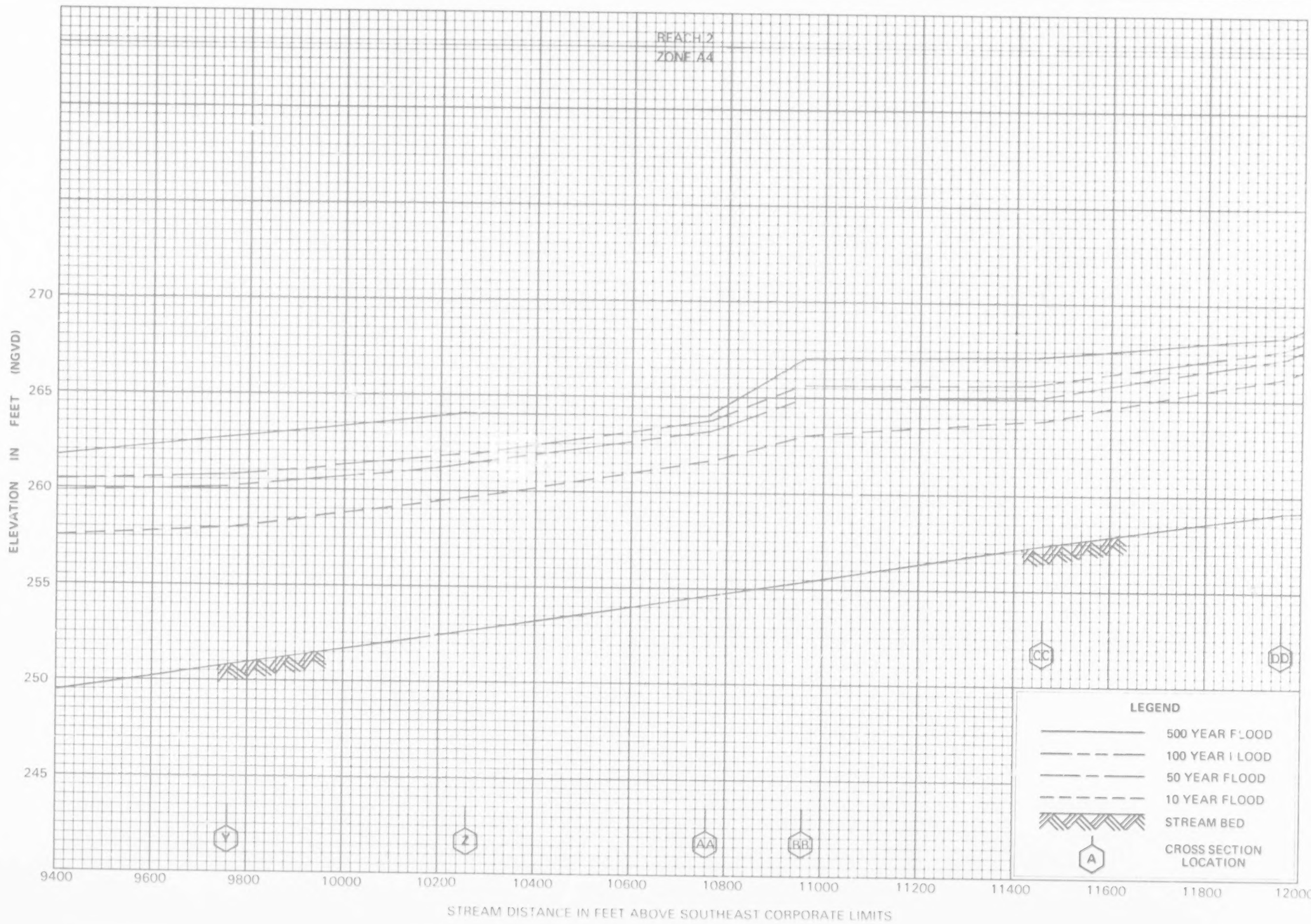


17P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF LUFKIN, TX (ANGELINA CO.)	FLOOD PROFILES CEDAR CREEK



18P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF LUFKIN, TX (ANGELINA CO.)	FLOOD PROFILES CEDAR CREEK



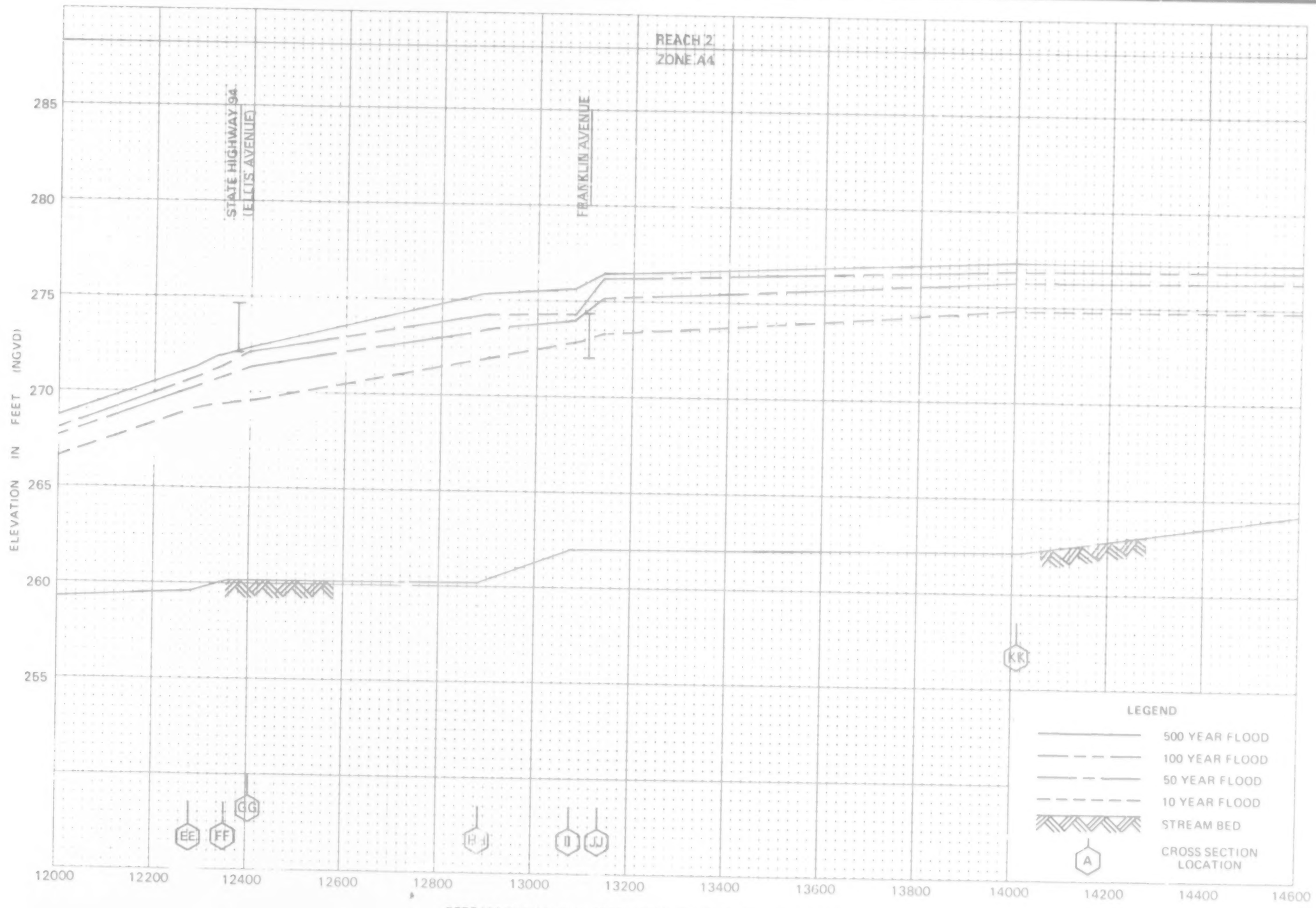
FLOOD PROFILES

CEDAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

19P



FLOOD PROFILES

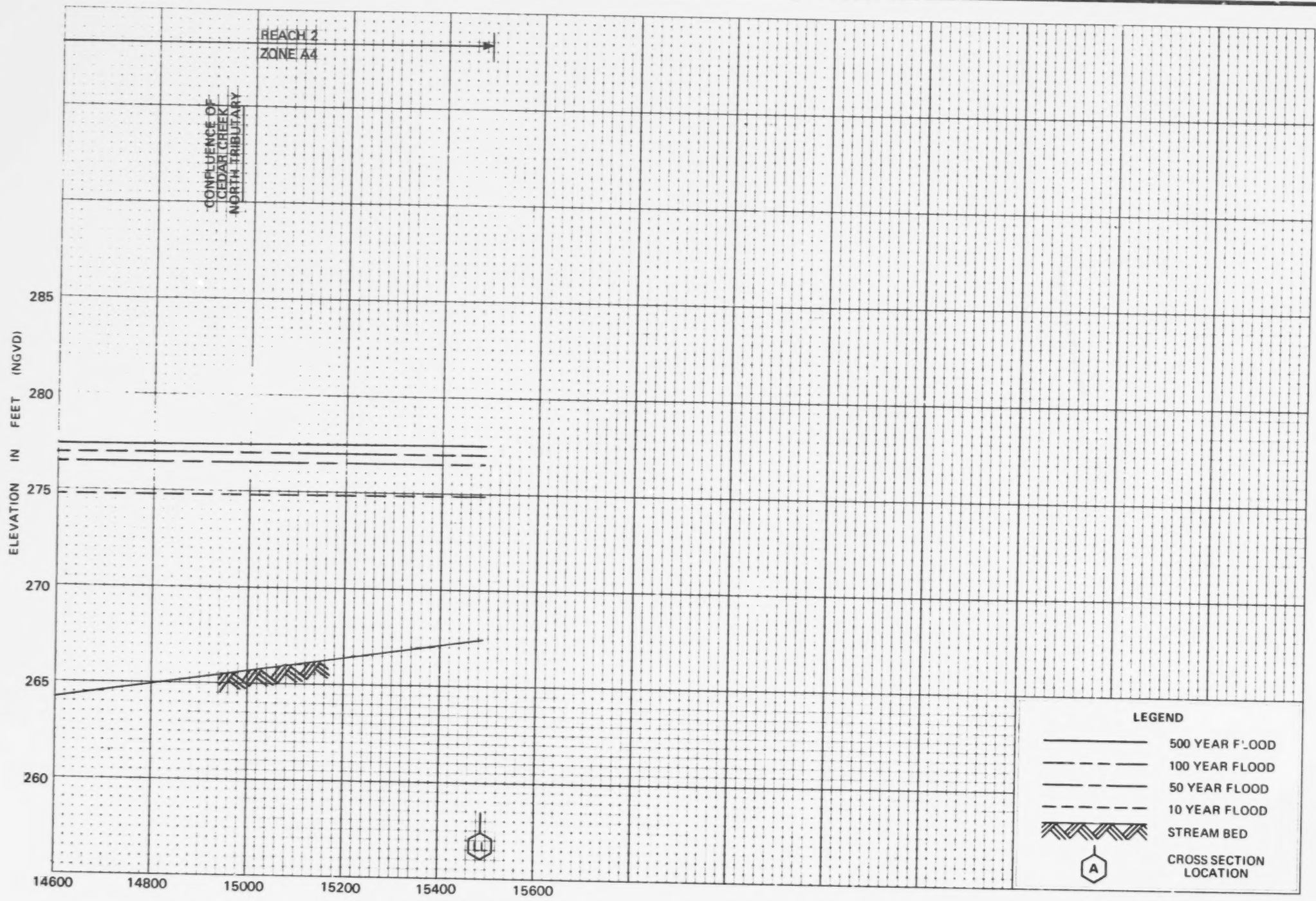
CEDAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

20P



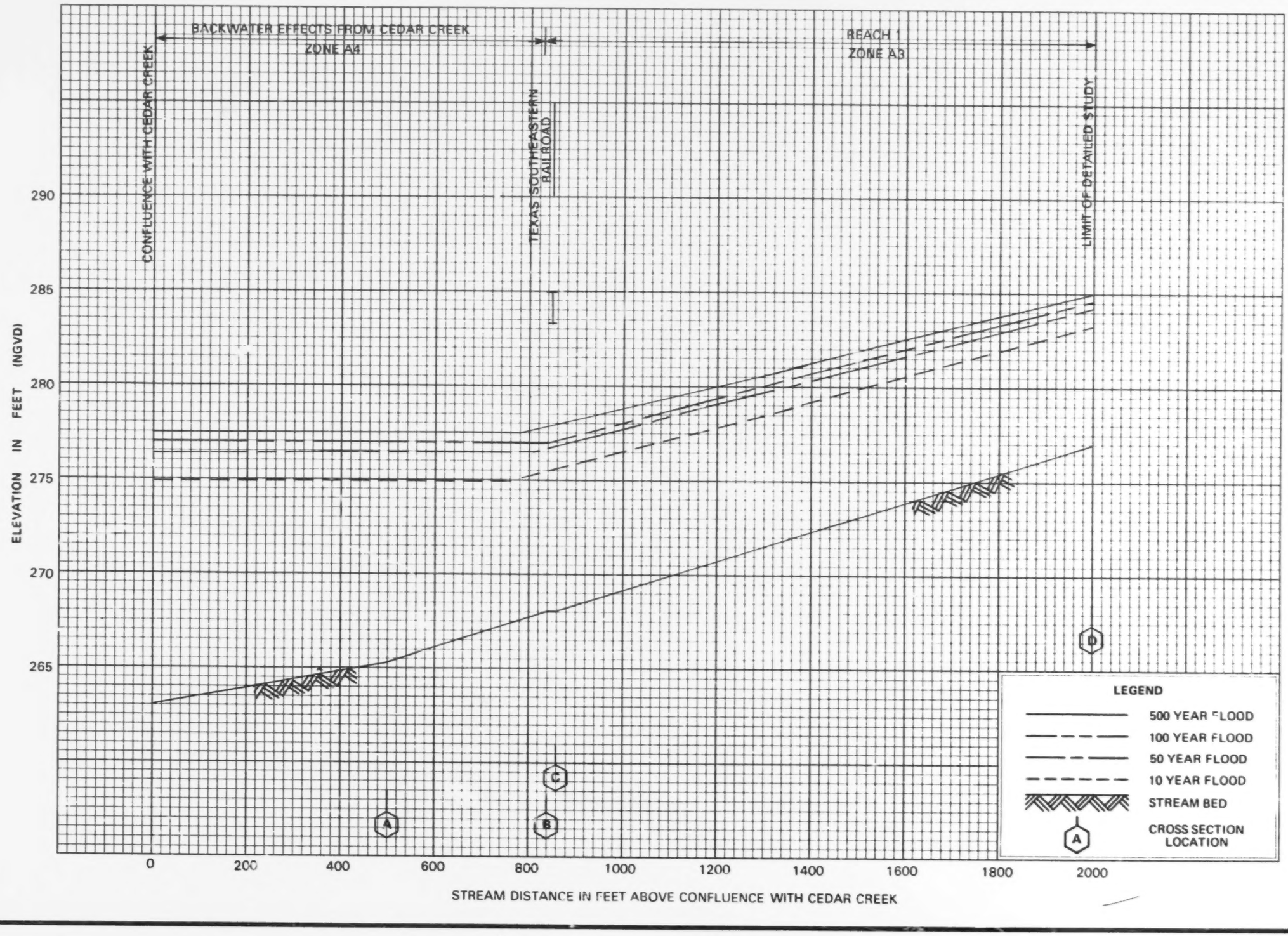
FLOOD PROFILES

CEDAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

21P



FLOOD PROFILES

CEDAR CREEK NORTH TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

22P

FLOOD PROFILES

CEDAR CREEK SOUTH TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

23P

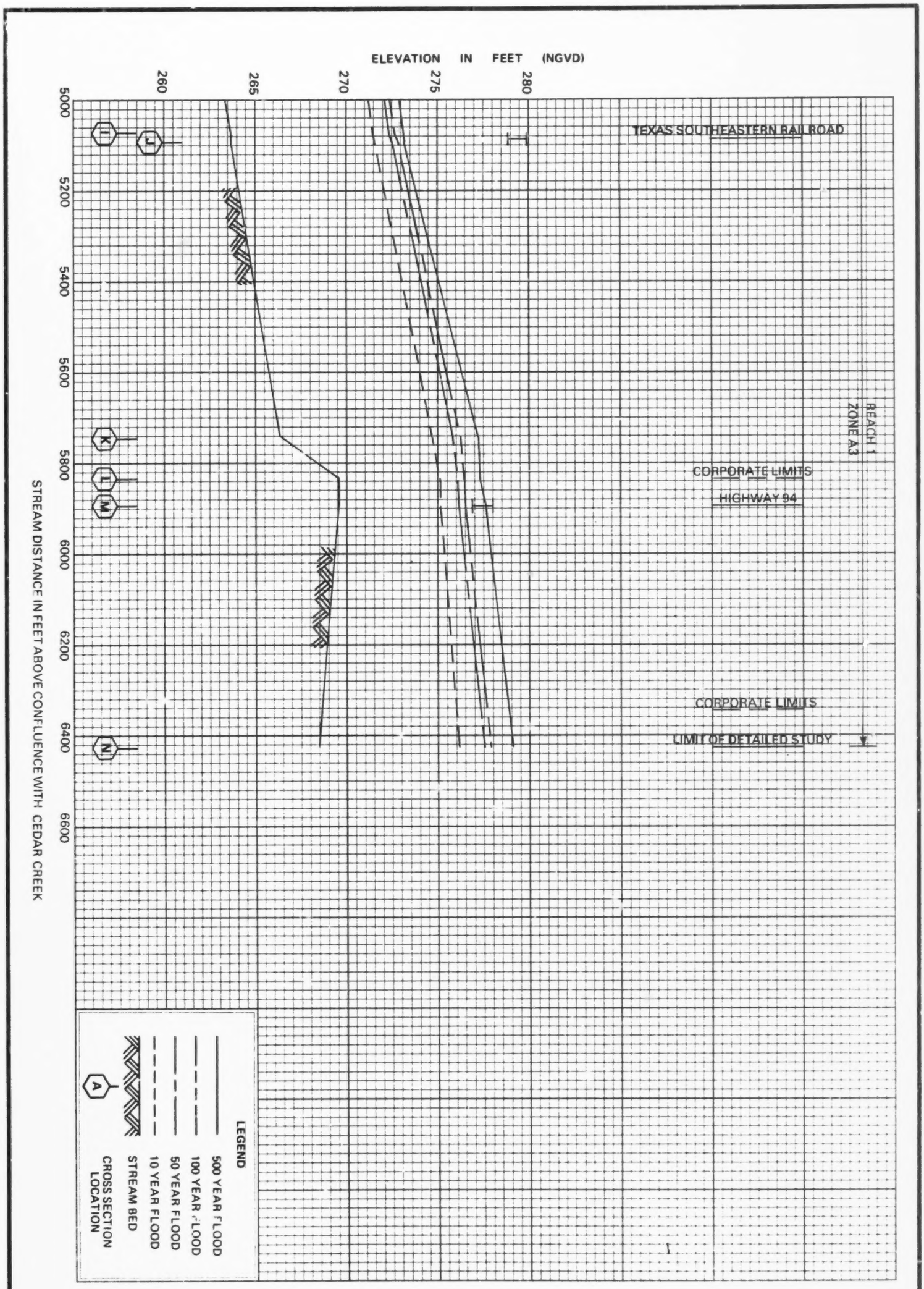
FLOOD PROFILES

CEDAR CREEK SOUTH TRIBUTARY

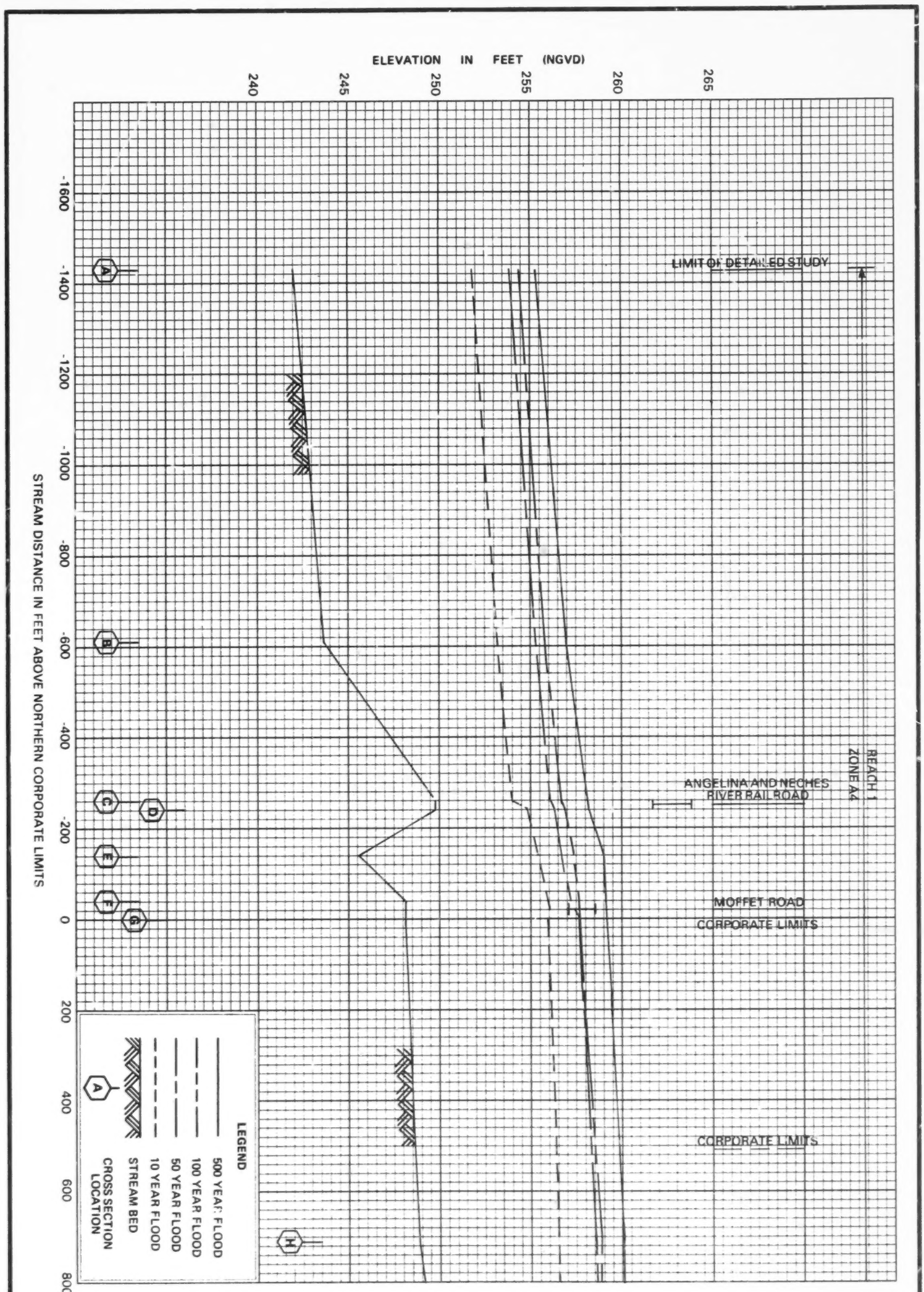
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

24P

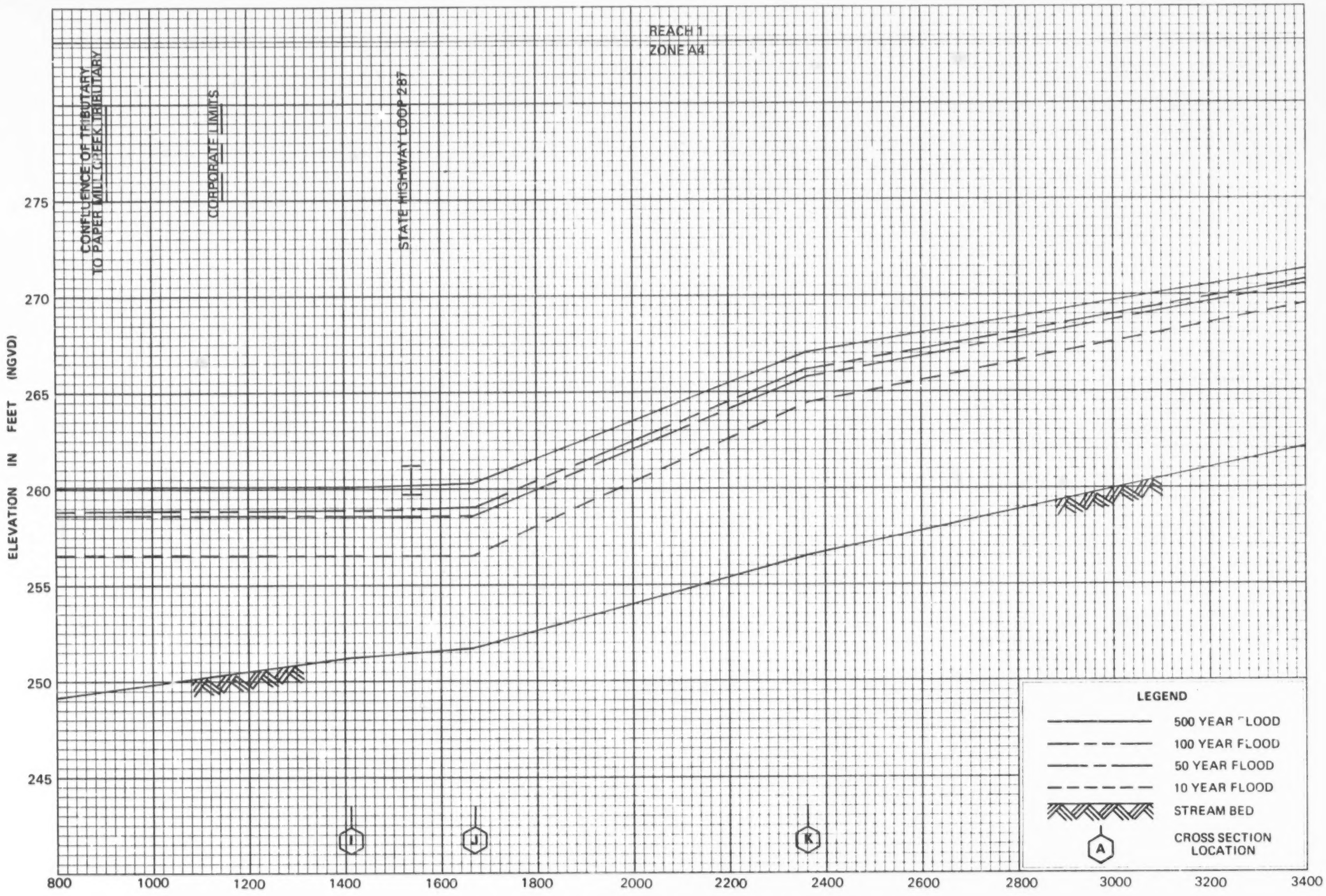


25P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF LUFKIN, TX (ANGELINA CO.)	FLOOD PROFILES CEDAR CREEK SOUTH TRIBUTARY



52

26P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF LUFKIN, TX (ANGELINA CO.)	FLOOD PROFILES PAPER MILL CREEK TRIBUTARY



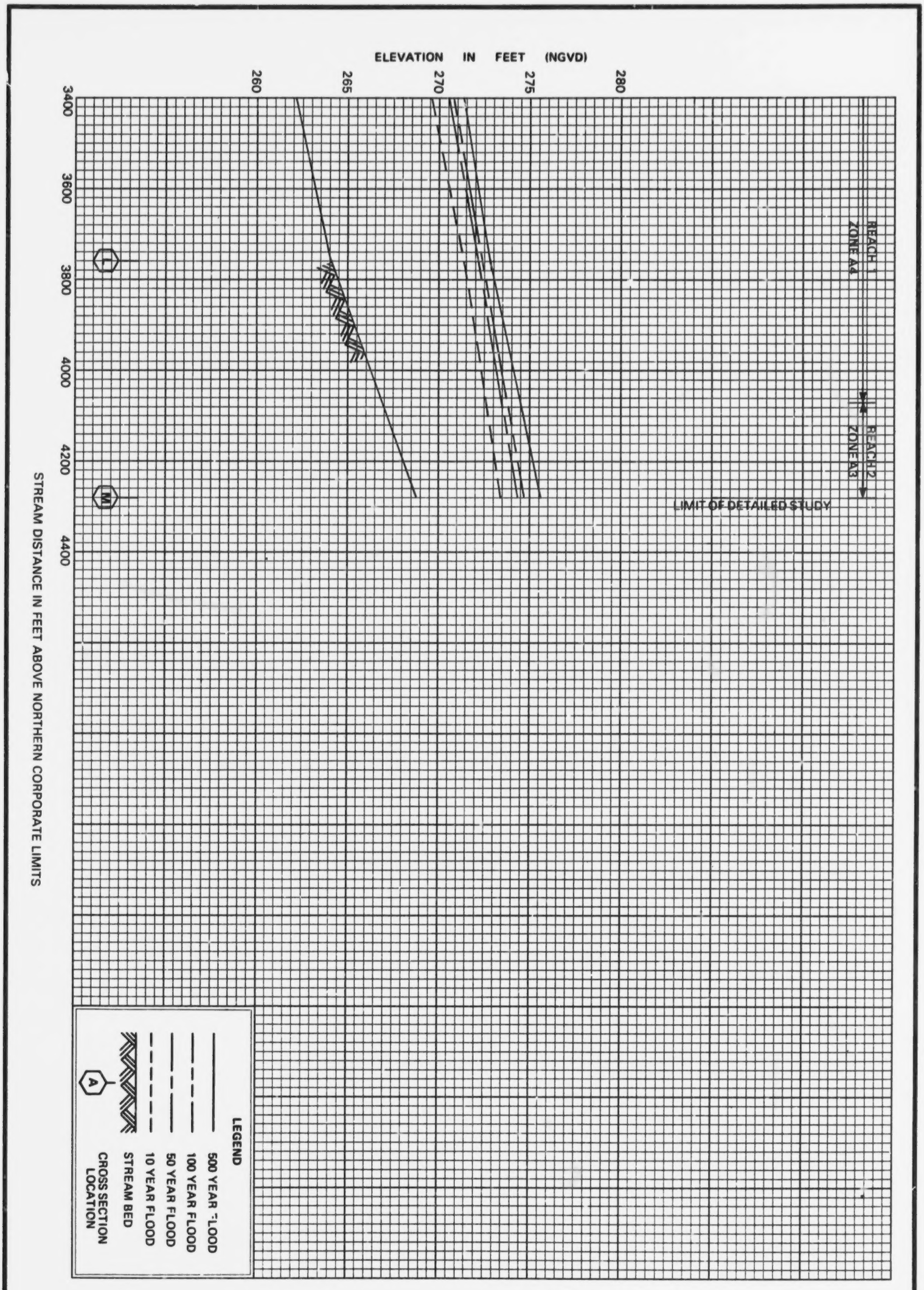
FLOOD PROFILES

PAPER MILL CREEK TRIBUTARY

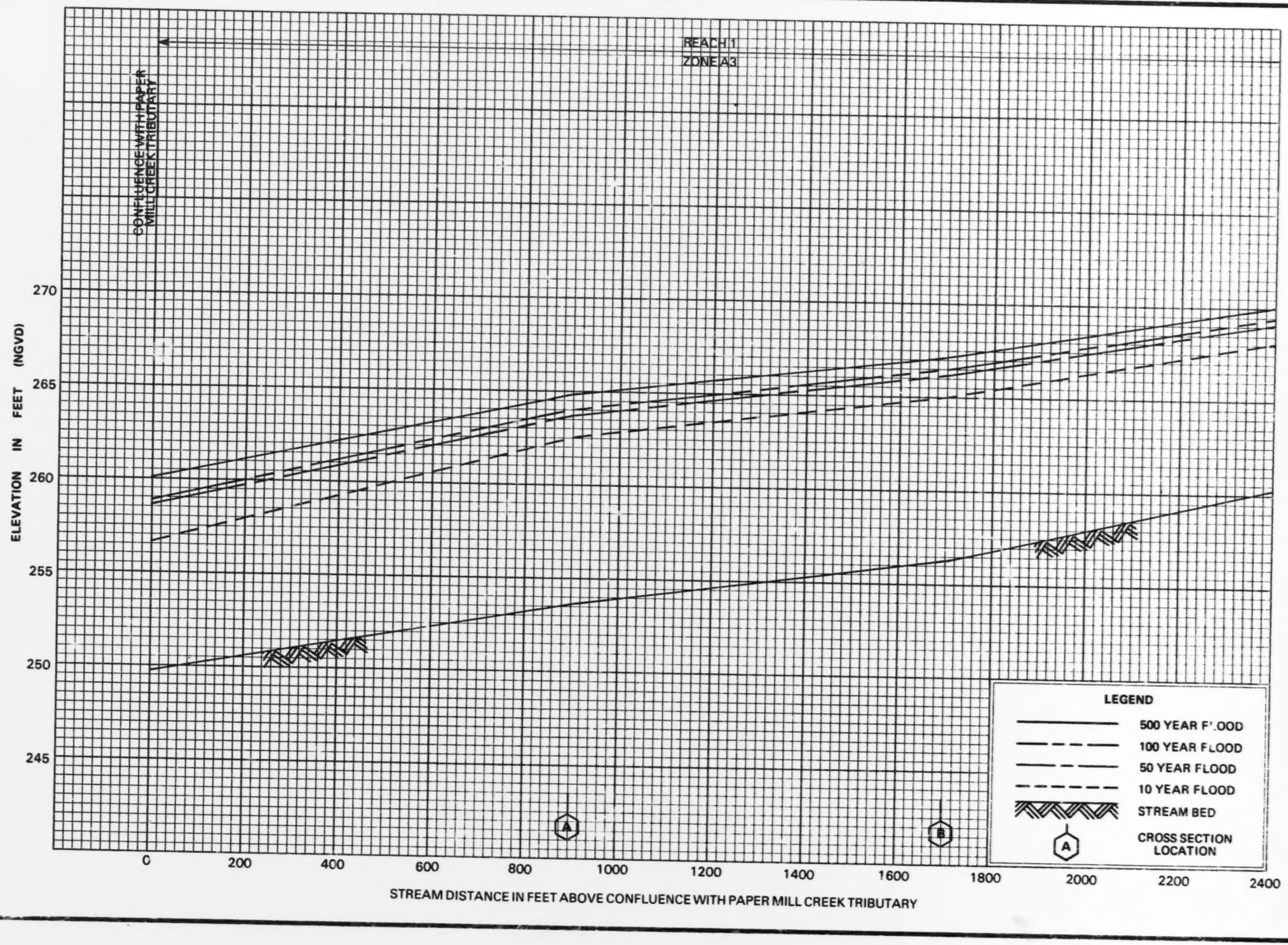
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

27P



28P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF LUFKIN, TX (ANGELINA CO.)	FLOOD PROFILES PAPER MILL CREEK TRIBUTARY



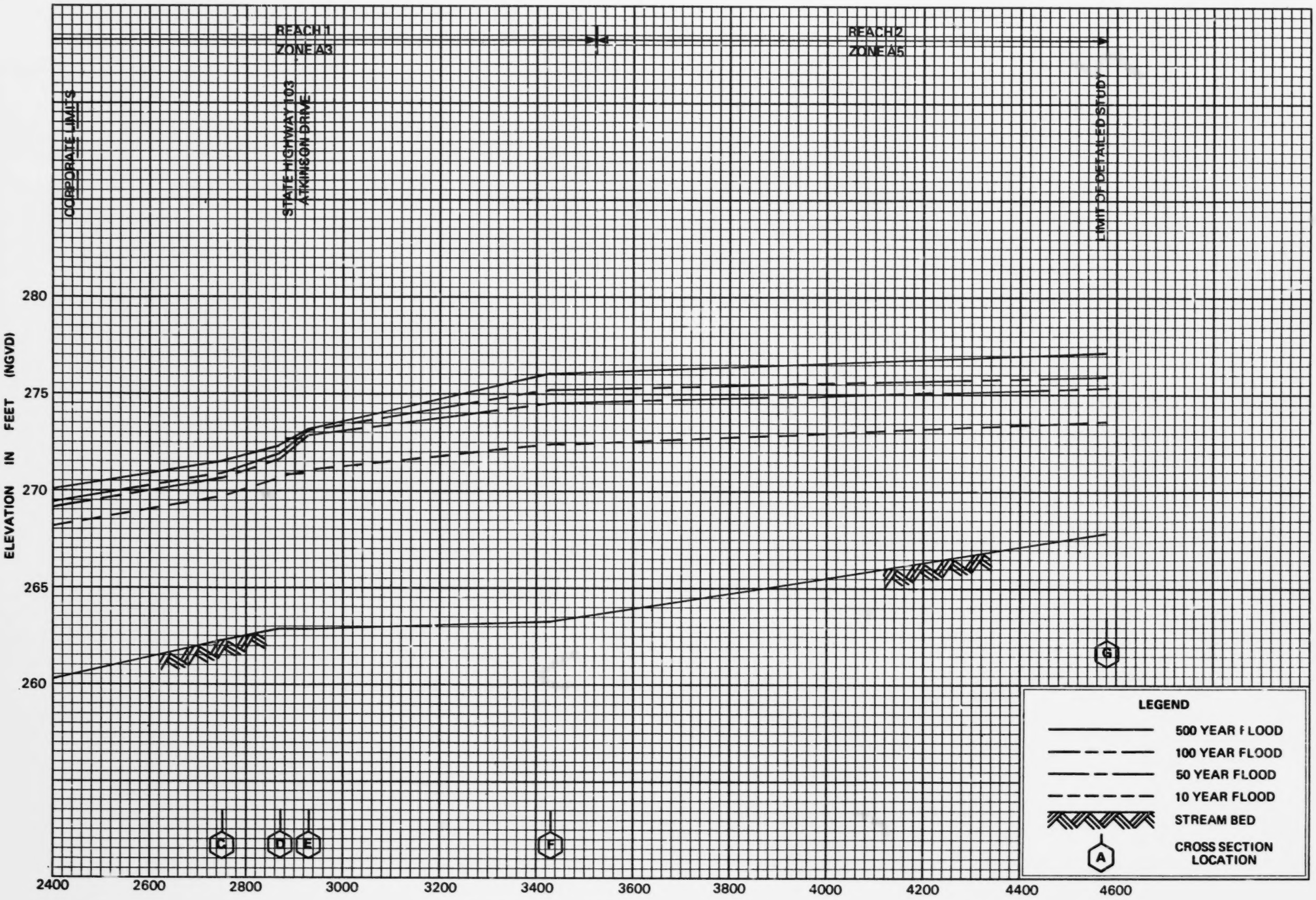
FLOOD PROFILES

TRIBUTARY TO PAPER MILL CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

29P



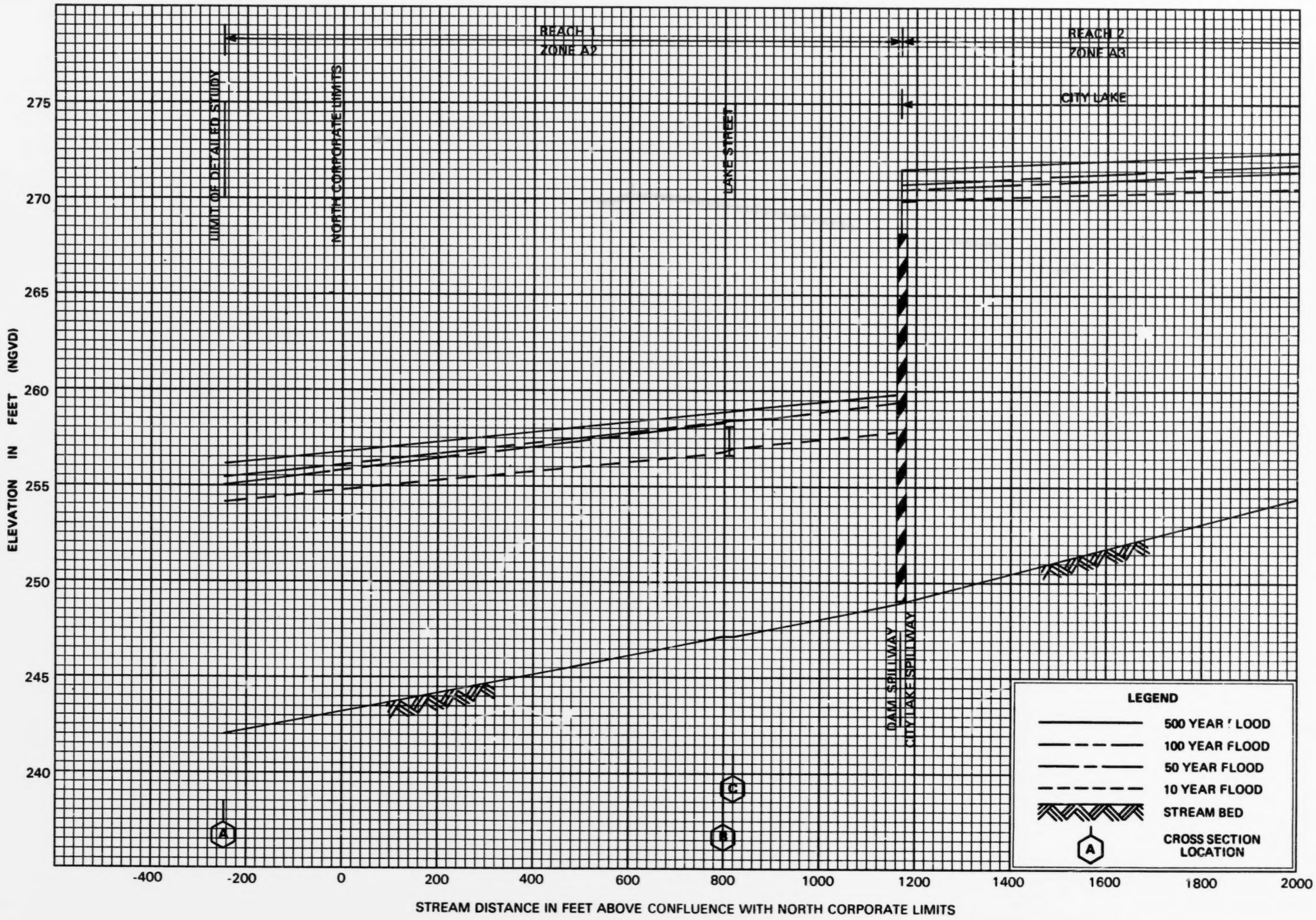
FLOOD PROFILES

TRIBUTARY TO PAPER MILL CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

30P



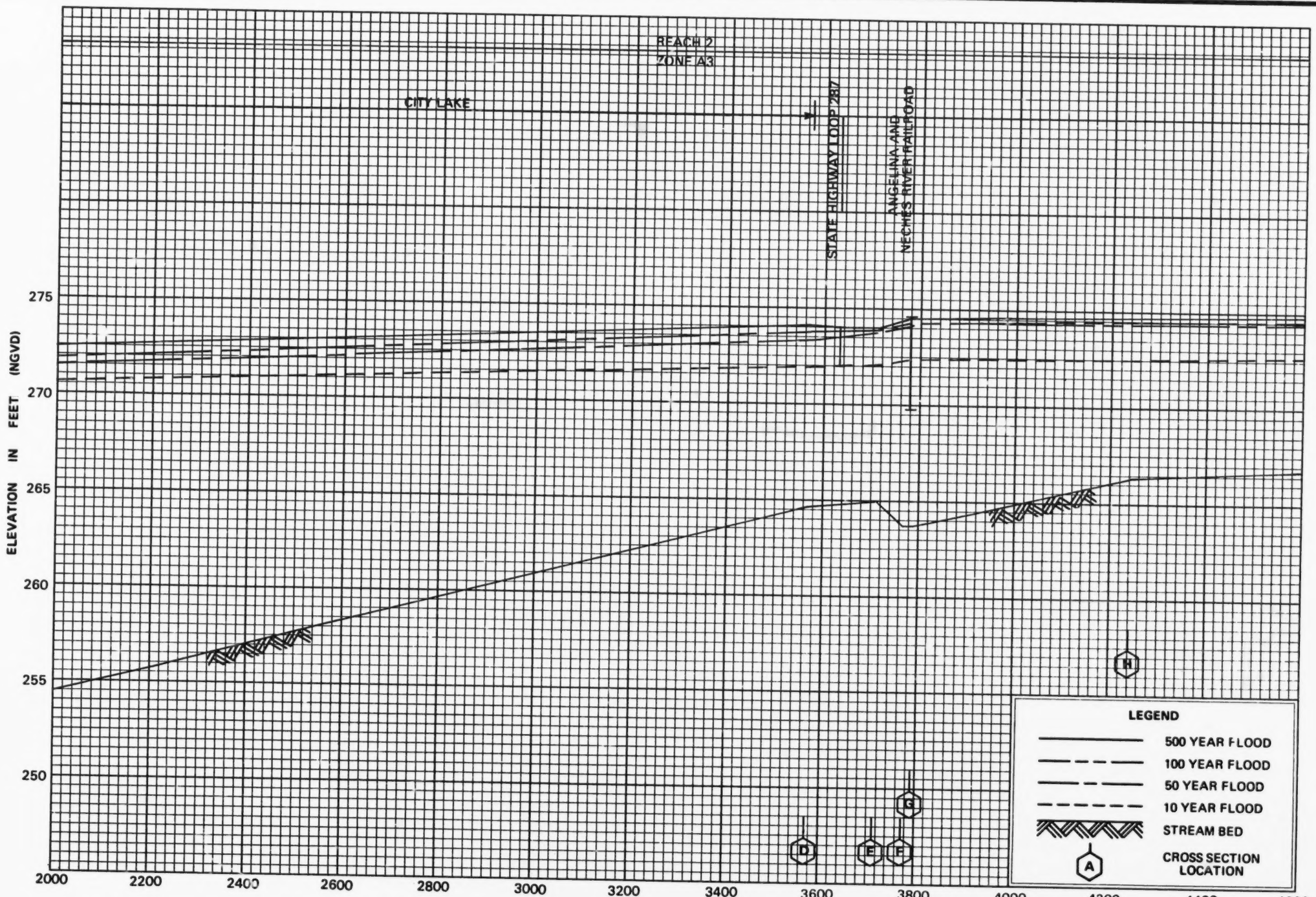
FLOOD PROFILES

MILL CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

31P



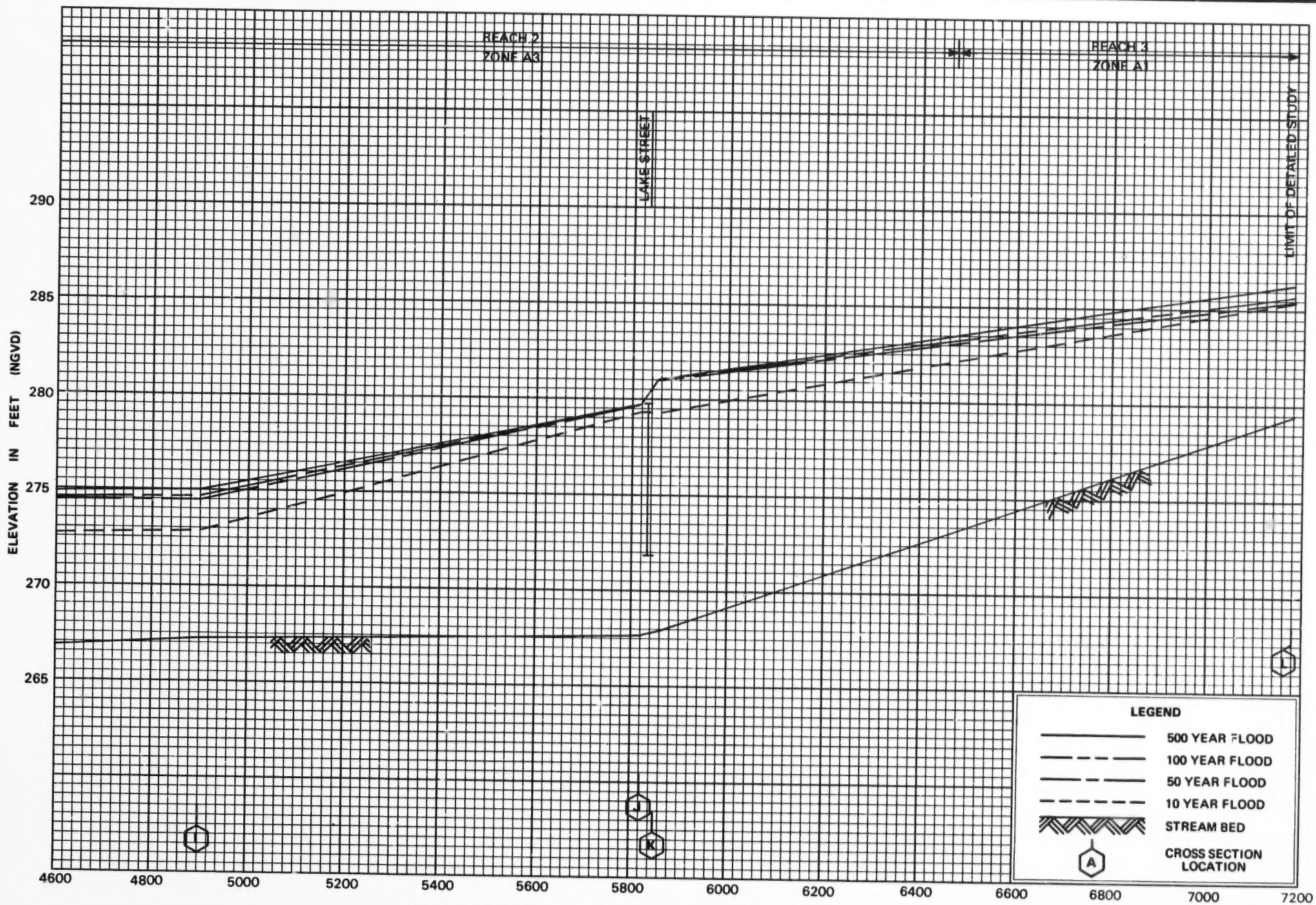
FLOOD PROFILES

MILL CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

32P



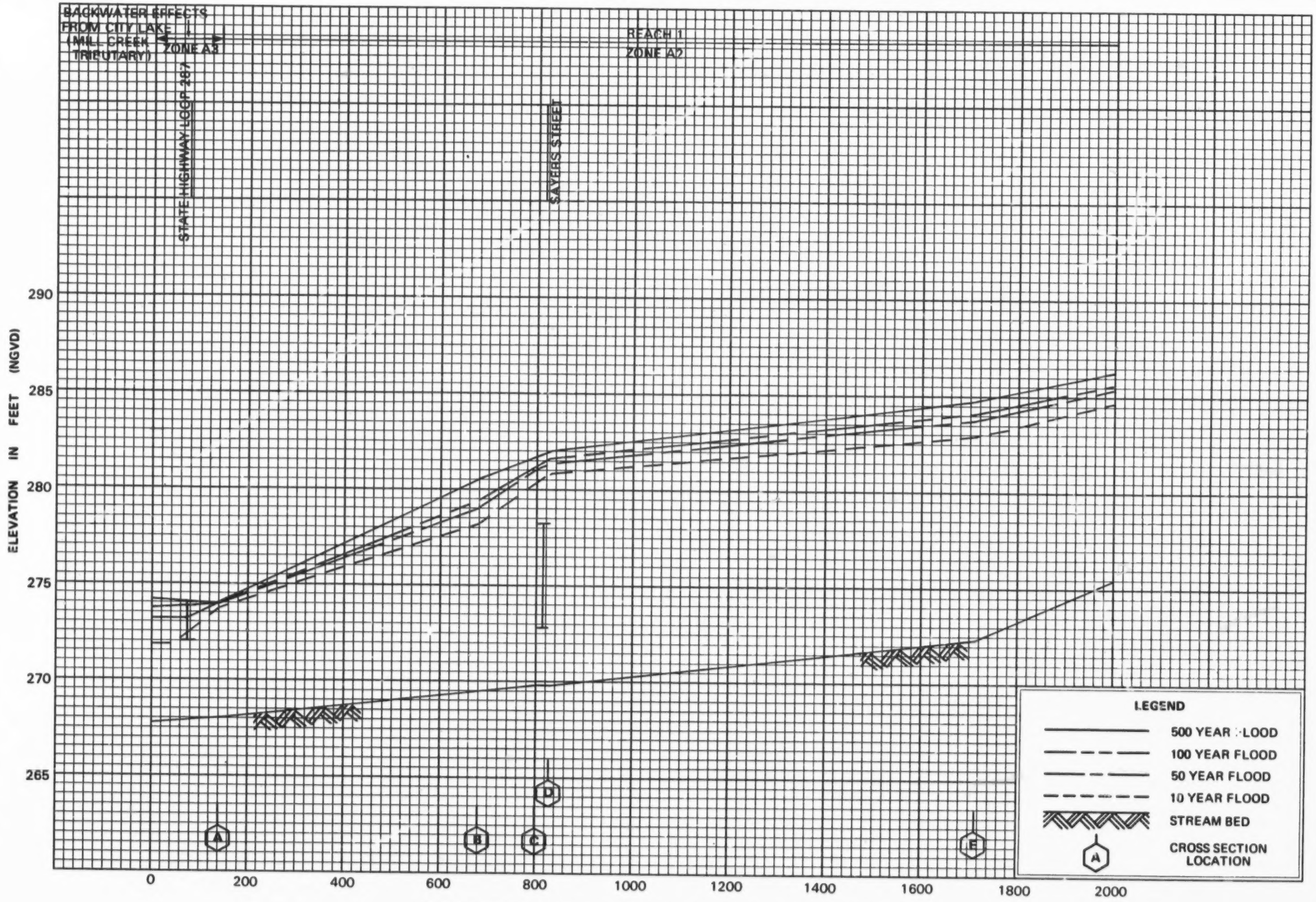
FLOOD PROFILES

MILL CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

33P



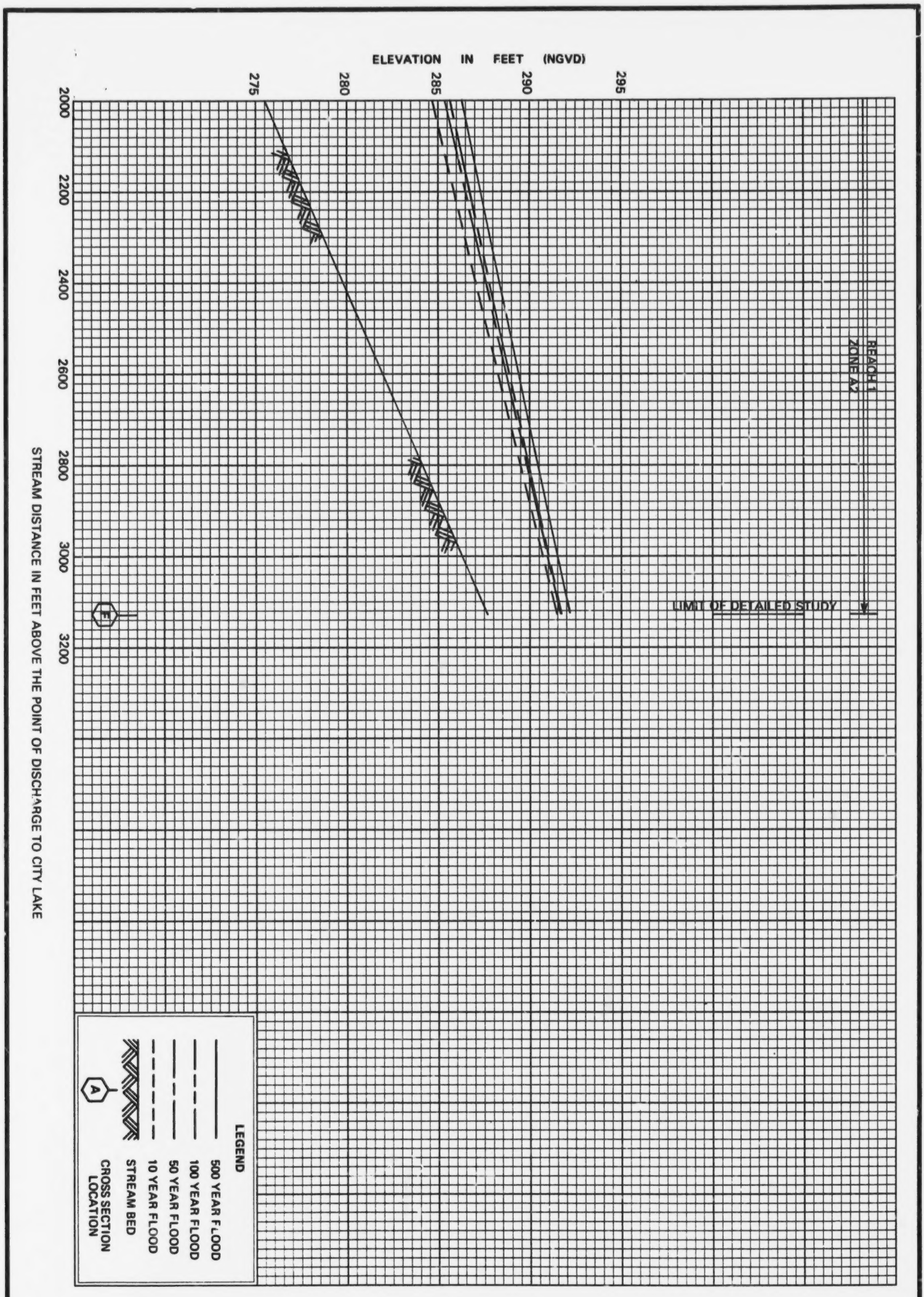
FLOOD PROFILES

TRIBUTARY TO MILL CREEK TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

34P



66

35P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX

(ANGELINA CO.)

FLOOD PROFILES

TRIBUTARY TO MILL CREEK TRIBUTARY

FLOOD PROFILES

HURRICANE CREEK EAST TRIBUTARY (E) TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LUFKIN, TX
(ANGELINA CO.)

36P